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THE IMPACT OF THE MARINE CORPS UNIFIED MATERIEL MANAGEMENT ON INVENTORY MANAGEMENT IN THE MARINE CORPS

BY

David Patrick Graham

Bachelor of Science

United States Naval Academy

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Business Administration of the George Washington
University in Partial Fulfillment of the
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Master of Business Administration

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Thesis directed by

John Norton, Ph.D.

Assistant Professor of Business Administration

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I. INTRODUCTION

The Federal budget has grown by leaps and bounds over the past few years, and the budget request submitted by the President for fiscal year 1969 is no exception. Needless to say, such increases in federal spending are viewed with some dismay by many, considering the tendency of today's economy towards inflation. Many congressmen and other government officials are increasingly looking for ways to reduce spending, either through elimination of programs or through more efficient operations.

As the single largest contributor to the size of the Federal budget, the Department of Defense and its component services -- Army, Navy, Air Force, and Marine Corps -- are subjected to a great deal of scrutiny from outside and from within the organization. As the Vietnam war continues to grow, so do expenditures, and effective management of resources becomes essential.

Such scrutiny is nothing new, however, to the United States Marine Corps. Since its rebirth in 1798 with a force of 33 officers and 350 enlisted, to its present size of 25,236 officers and 276,686 enlisted,[1] the Marine Corps has weathered many attacks against its right to exist.

It has managed to survive these attacks through its outstanding combat record and by its ability to survive on minimal and second-hand resources obtained from the other services.

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[1] *Navy Times*, February 7, 1968, p. 14.

The advent of modern warfare has necessitated the maintence of highly sophisticated and expensive weapons and materials. The Marine Corps can no longer survive with hand-me-downs. It is no longer a small fraternity which can be operated by a handful of dedicated men The diversification of responsibilities and the extensive areas of deployment has necessitated the development of dynamic and effecient management systems. Expenditures for the Marine Corps have increased to well over the billion dollar mark, and there are no forseeable decreases in the immediate future.

Developments such as this were not unexpected and actions were initiated during 1963 to find ways of coping with the predicted developments within the supply, fiscal, and logistic areas. The magnitude of these developments were expected to have a direct bearing on the organization of future military supply systems. The introduction of new management tools and techniques throughout the Department of Defense (e.g. Program Evaluation Review Techniques(PERT), Planning-Programming-Budgeting System (PPBS), Resource Management System(RMS), etc.) were greatly affecting the economic ability to maintain a supply system which could effectively satisfy the ever increasing supply requirements of the Fleet Marine Forces. Although highly mechanized at this time, the dynamic state of affairs made a critical analysis of the existing system imperative for future operations.

To perform this analysis two groups were formed; the first in 1963 and a second in 1964. The first group was assigned the task of developing a Marine Corps Supply System Organizational Structure. The main consideration of this committee was to provide maximum effective supply support to Marine Corps forces. This was to be accomplished by examining existing and

forecasted trends in military supply operations. The system which they proposed was expected to take full advantage of advances made in automatic data processing equipment through a total integration of modern fiscal, logistic, and supply philosophies and management techniques.[1]

While the recommendations of the first group were under study at Headquarters, Marine Corps, a second group was organized to design and develop a supply system compatible with current DoD systems -- Military Standard Requisitioning and Issue Procedures(MILSTRIP) and the Military Standard Reporting and Accounting Procedures(MILSTRAP). This task was later expanded to encompass an examination of the feasibility of implementing the supply distribution system recommended in the report of the first group. The group recommended that simultaneous execution of such a new centralized system and MILSTRIP/MILSTRAP would be a step in the right direction. The second group went on further to develop the specifications for the new system. The new system, entitled the Marine Corps Unified Materiel Management System(MUMMS), was approved by the Commandant on December 20, 1964.

The system was conceived to be:

> ...an integrated system of supply management that is designed to satisfy all internal and external requirements of the Marine Corps by utilizing modern management and automatic data processing techniques at a single Inventory Control Point(ICP) and several Remote Storage Activites(RSA). Moreover it is fully compatible with all standardized requirements of DoD; such as MILSTRIP, MILSTRAP, MILSTEP(Military Supply and Transportation Evaluation Procedures), MILSTAMP Military Standard Transportation and Movement Procedures);

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[1] Letter from the Commandant of the Marine Corps for the purpose of establishing a Committee to Develop Supply System Organizational Structure, April 15, 1963.

and further, with DSA(Defense Supply Agency) and MOWASP(Mechanization of Warehousing and Shipment Processing).[1]

As mentioned above, implementation of MILSTRIP/MILSTRAP and compatibility with other DoD systems was a guideline and factor for the redesign of the Marine Corps Supply System. Although this constituted a major factor for consideration in the system design, there also existed a requirement to provide the Commandant of the Marine Corps with the capability to retain the integrity of the total supply system so as not to jeopardize the primary mission of maintaining a force in readiness. In addition, it was deemed beneficial to centralize the supply system to more effectively utilize the rapidly advancing computer technology.

There were many benefits envisioned by the implementation of MUMMS. Primarily, a more rapid response to supply demands was expected through the use of the Automated Digital Network(AUTODIN) of DoD and a near real time computer processing of demands. Also, a more effecient use of system assets was expected through centralizing accounting and inventory control. This would result in lower system stock levels and a more rapid and effecient inventory turnover. Centralized accounting and the ready availability of data would also provide more timely, accurate, and meaningful management reports.

It is the purpose of this paper to look at the Marine Corps Unified Materiel Management System and examine its effects on inventory management within the Marine Corps. The complexity and scope of the system prevents a minute and detailed examination of MUMMS, but attention

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[1] U.S., Department of the Navy, Headquarters, Marine Corps, Marine Corps Unified Materiel Management System(MUMMS) Intrduction Manual, Marine Corps Order P4400.70, June 25, 1966.

will be directed toward the broader implications which this system has had on management techniques.

This paper will first contrast the approaches to inventory management as they exist both in a military and non-military setting. This examination will deal with a few aspects of management philosophy in this area in the hope of establishing the justification of applying what are essentially industrial concepts to a military problem.

To provide the base from which the design and development of MUMMS was launched, the third chapter will trace the history of supply management from the earliest days of the Marine Corps until the period before MUMMS was implemented. This should help to identify areas which are peculiar to the military; more specifically, to the Marine Corps. Although the past does not directly affect current operations, it provides a conceptual framework which influences, in fact forms, the emerging managerial philosophies and techniques.

Following this chapter, the paper will then turn its attention to the design and development period for MUMMS, and trace the steps by which the Marine Corps made the transition from the previous supply system. The concepts and management priciples which served as guidelines will be identified and discussed in this chapter.

The fifth chapter will examine the end product as it exists today, the Marine Corps Unified Materiel Management System. It will depict, on a broad scope, what MUMMS encompasses and what it purports to do.

To generate a better feeling for the complexities of the total system, this chapter will also look at each of the sixteen subsystems separately. Although this paper will view them individually, the subsystems

are integrated to form the total system; and the interfaces between the subsystems will be isolated and identified. The survey of the subsystems will be directed primarily toward their key features and concepts, and much of the detailed functioning will be omitted. Charts and diagrams will be interspersed throughout to clarify the subsystems and to more accurately depict the interfaces between them.

As the system has only been in operation, and as yet not totally operational, since May 1, 1967, much of the evaluation remains only conjecture and not factual. One subsystem, however, has been almost totally operational since MUMMS was implemented, and it is in this area that operational effects can be more readily and accurately identified and measured.

For this reason, the sixth chapter, which attempts to evaluate the system, will concern itself primarily with the Inventory Control subsystem. Although it is only one of a total of sixteen subsystems comprising the overall system, it is by far the largest, both in complexity and activity and in importance. Based on this fact, it is felt that it should provide a reliable measure on which to predicate an evaluation of the overall system, and how it is progressing or regressing, as the case may be.

The final chapter will attempt to tie the loose ends together and present some conclusive observations on the relative merits, or lack thereof, of MUMMS , and some idea of where it is taking the Marine Corps in the field of inventory management.

The vast majority of the information on which this paper is based was collected from the pertinent Marine Corps orders dealing with MUMMS. These publications, however, dealt mainly with the operational aspect of

MUMMS and little with the path taken or the underlying theories for its conception. This latter type of information, the primary concern of this paper, was collected through interviews with personnel at Headquarters, Marine Corps in Arlington, Virginia and the Marine Corps Supply Activity in Philadelphia. These people were the ones responsible both for its development and its administration. In addition, extensive use was made of staff studies conducted for the purpose of designing and developing MUMMS.

As was implied earlier, and reiterated more specifically at this point, this paper was not written to supplement or replace the manuals written on MUMMS, which are concerned with its operational aspects. It was written to examine the implications which the system has generated for inventory management. To do this, the paper will, as indicated earlier, look at the development of MUMMS; the concepts on which it is based; and the effects which it has had on inventory management in the Marine Corps.

II. INVENTORY MANAGEMENT: MILITARY VS NON-MILITARY

Over the years there have been many attempts to relate the activities of military organizations to those of similiar industrial organizations. Many people maintain that a clear relationship does exist. Still others insist a comparison serves little purpose since the two operate in such different environments.

The fact of the matter is, however, that these relationships do exist and each can profit by studying the operations of the other. Perhaps the most apparent area where cross-applications exist is that of inventory management.

Although an industrial concern operates on the basis of making a profit and the military activity is essentially a non-profit one, there is a point in common which necessitates improved inventory management -- limited resources. This has always been a problem for industry, but there had always seemed to be an attitude within the military that there was no limit to the funds which they could expend.

In recent years, however, there has been a sharp reversal in this thinking within the military. Continued budget deicits, growing expenditures within the Department of Defense, and the present threat of a tax increase have focused the attention of the government and the American people on the military programs being conducted. Defense still remains an essential commodity, but now, more than ever before, it must be effecient

as well as effective, defense. With this in mind, there has been an increased emphasis in the military on inventory management.

A study conducted by The Diebold Group, Inc. in 1962 described the functions of inventory management within the military as follows:

> The basic objectives of inventory management are to reduce the dollar value of inventories and the annual cost of storing those inventories while at the same time improving their ability to support military forces, both under current levels of operation and under wartime conditions. Additional objectives are to eliminate unnecessary cross-hauling, to accomplish timely phase-out and disposal of non-standard or obsolete supplies, and to maximize interservice support.
>
> In a very real sense, inventory management attempts to function in such a way that the combat effectiveness of the Armed Services as a whole is the highest which can be obtained within the limits of available manpower, materiel, funds, and legislative authority.[1]

A similiar description is found for the objectives of inventory management in the industrial sphere:

> ...to minimize dollar investment; to maximize service; to prevent stock outs; to control warehouse space and to control transport.[2]

To see the compatibility between the philosophies -- military and non-military inventory management -- one only has to look at a few of the techniques employed. It is readily apparent when examining the problem of how often and how much to order at any given time. Forecasting demand and the determination of safety levels are other areas where the two can be readily compared.

Deciding the optimum quantity to procure has long been a problem

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[1] The Diebold Group, Inc., Military Logistics Management Indices, (Washington, D.C.: The Diebold Group, Inc., 1962), p. vii-1.

[2] James A. Constantin, Principles of Logistics Management, (New York: Appleton-Century Crofts, 1966), p. 332.

for the inventory manager. This problem has been under study for a great many years. It is generally accepted that the first constructive breakthrough in this area, the economic order quantity (EOQ) formula, was developed during the years 1925 to 1927.[1] Sometimes referred to as the standard square root formula, it provided a means for equating the cost of ordering to the cost of maintaining stocks. Also called the Wilson EOQ formula because it was later adapted by R.H. Wilson to deal with quantity discounts, the literature on inventory management techniques shows only a variation in symbols when discussing the EOQ formula.[2]

In 1958 the economic order policy was promulgated by the Department of Defense for adoption by the military services for consumable items stocked on the basis of repetitive demand. The formula adopted was the standard EOQ formula utilized heavily by industrial firms, differing only in notation:

$$Q = \frac{2AC}{H} \quad \text{where}$$

Q is the economic order quantity in dollars
A is the annual demand in dollars
C is the cost to order in dollars
H is the cost to hold expressed as a percentage per year[3]

All of the military services have implemented the EOQ policy at some level of supply but their approaches have been slightly varied. Both the Navy and Marine Corps have implemented this approach at their Inventory Control Points. The Army, on the other hand, initiated this practice at the user level, but later switched to the major consumers. Air Force

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[1] Thomas M. Whiten, The Theory of Inventory Management, (Princeton, N.J.: The Princeton University Press, 1957), pp. 31-32.

[2] Martin K. Starr and David W. Miller, Inventory Control: Theory and Practice, (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1962), pp. 79-81.

[3] U.S., Department of Defense, Peacetime Operating and Safety Levels of Supply, (Washington, D.C.: Department of Defense, June 24, 1958).

implementation was on a slightly modified scale at the ICP and Depot level, along with a Selective Management Program concerned with the Hi, Medium, and Lo-Value sales range.[1]

Full implementation of EOQ policy has been retarded somewhat by the inability of the services to develop precise cost to order and cost to hold values.[2] The nature of this problem was discussed in a publication by Martin K. Starr and David W. Miller:

> There is no general approach to the problem such that when we apply it we can be assured that we will be achieving correct measurement of costs. On the contrary, in practice we are forced to utilize whatever ad hoc methods can be discovered which seem applicable... Generally, it is possible to measure all the costs involved in the usual kind of inventory situation with sufficient accuracy to achieve a resolution of the inventory decision problem. We say sufficient accuracy because... the optimal course of action is not likely to be very much changed by even relatively large errors in the measurement of costs. This fact helps to reassure us that our conclusions will be essentially correct even if we are unable to obtain precise cost measurements.[3]

Prior to 1958, military services utilized in most cases a fixed safety level of stocks. To take advantage of rapidly developing mathematical and management techniques, the Department of Defense directed the military services to incorporate a variable safety level into their inventory management programs:

> C. The objective of this instruction is to provide for more effective and economical operating and safety levels of supply for these items (minor secondary consumables) by utilizing:

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[1] David F. Morrow and James H. Smeds, "An Investigation Into The Practical Problems Inherent In Implementing Advanced Materiel Management Techniques," (Unpublished Masters thesis, U.S. Naval Postgraduate School, 1964), p. 19.

[2] Ibid.

[3] Starr and Miller, op. cit., pp. 13-14.

> 1. Economic order and procurement principles for the establishment and maintenance of optimum operating levels.
>
> 2. Probability principles for the establishment of safety levels which will provide required protection against an out-of-stock position.[1]

This same directive listed certain factors which were to be considered for determining the safety level. These factors included frequency and size of the demand, reliability of suppliers, and mission of the unit, as well as military essentiality of the item.

The principles of statistics and probability enter heavily into calculating the most effective levels of safety stocks. Statistics provides the means of estimating future demand while probability provides a hedge against variations in demand from what was expected.

The fixed safety level does not afford this flexible protection:

> The same allowance is made for items of extreme importance as is made for items of negligible importance. It would seem sensible to have larger safety allowances for the more important categories of items than for those of small importance.[2]

The key determinant for effective management in the area of economic order quantity and safety level is the ability to predict demand. There have been a great many advances in this area in the past few years. One of the most effective tools to have been made available for determining demand is the statistical forecasting system developed by Robert H. Brown. These systems have developed from a single smoothing model into a triple smoothing model.[3]

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[1] U.S., Department of Defense, loc.cit .

[2] Whiten, op. cit., p. 228.

[3] Robert G. Brown, Smoothing, Forecasting, and Prediction, (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963), p.69.

In light of the multitude of mathematical approaches to forecasting demand there seems to be a basic approach to the Variable Safety Level problem. The method suggested by IBM is the same as that used by the Defense Medical Supply Center. Many of the programs are developed and available to the user of IBM equipment. These programs were developed primarily for industrial concerns, but they could easily be adapted to military use.[1]

Not only do the methods of calculation coincide, but also the considerations for calculating the safety level parallel each other. Dean S. Ammer enumerates several factors for industrial concerns such as a reasonably steady and predictable usage, as well as a short lead time. These compare favorably with the factors set forth by the Department of Defense.

One area of consideration which might appear to be incongruent on the surface is that of military essentiality. It might at first seem a problem peculiar to the military but it is really only a problem of semantics.

Essentiality and the ranking of essential items is a problem for the industrial inventory manager as well as the military. Mathematical models are available to him for almost every facet of his operation with the exception of this one area. Here, it would appear he must rely solely on his intuitive judgment in establishing priorities. This problem becomes even more accute when the constraints of a budget ceiling are coupled with a situation where demand and lead time are uncertain.[2]

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[1] Morrow and Smeds, op. cit., p. 35.

[2] F.J. Jablonsky and C.W. Rixey, "Military Essentiality in Inventory Management," (An unpublished Masters dissertation, U.S. Naval Postgraduate School, 1961), p. 16.

This aspect of inventory management is treated in a somewhat minor detail in the more sophisticated mathematical models through the inclusion of a penalty function for unfilled demand. It can occur in the case of sales and/or production shortages.

The latter case has similiar implications for both military and non-military. This can be readily seen by substitution of the word "mission" for "production". Neither can adequately function without the required item and they fall short of their objectives without drastic action.

On the other hand, a shortage for sales purposes does not have the same implication. A commercial shortage will result in a loss of profit and possibly "good will" but the customer has the alternative of going to a store around the corner. This alternative is not available to the military. Shortages require expensive and time consuming procurement processes which endanger the mission of the military.

All the consequences are similiar but their ultimate effect seems more dramatic in the military. Perhaps this is the reason the military has taken steps to solve these problems analytically through mathematical tools; while the commercial community seems content to rely on purely judgement decisions at the operating level.

Regardless of the reasons, the military essentiality code has given the manager a method of selecting items which are critical for a particular weapons system and ensuring that the item is on hand. This becomes a little more difficult when an attempt is made to assign essentiality codes to items of a general support nature. It is interesting to note that an intensive study by the Defense General Supply Center, with

the aid of the military services, resulted in the assignment of essentiality codes for nearly 19,000 items of this classification.

The approaches of economic order quantity and variable safety levels, with their major ingredients of statistical forecasting and military essentiality codes, have generated a new era for the military manager. They have served to promote more effecient and effective inventory management through the utilization of advanced inventory techniques. As these techniques become more refined, there should be an increased use of standard models throughout the military establishment. Thus, the operations of military and commercial activities will become even more dependant on similiar approaches to the inventory management problems.

This trend cannot help but benefit both parties. Personnel-wise, the military lacks the time and expertise to develop sufficient analytical techniques. On the other hand, the military can provide the assets and setting for testing these techniques from an actual operational viewpoint. If the two contiue to function in this manner, the best of both approaches can be incorporated into an overall management philosophy which will benefit the whole economy and provide an effecient, as well as an effective, military community.

To see how the Marine Corps has advanced through the various states of the art, the next chapter will trace the development of supply and management philosophies and techniques up to the design and development of the Marine Corps Unified Materiel Management System. The stages of this development show the increasing attention to promoting efficiency.

III. HISTORY OF SUPPLY SYSTEMS IN THE MARINE CORPS

The history of the United States Marine Corps is well documented with regards to its combat operations. Little has been recorded, however, about the supply aspects of its operations, but this comes as little surprise.

Since its inception in 1775, the Marine Corps has prided itself on being able to operate on a "shoestring". This ability was indeed one of the main reasons the Marine Corps has successfully avoided being disbanded on several occasions.

Indeed, the early years of the Corps were ones where the whole nation, struggling for its place in the world, placed a high premium on resourcefulness. It has only been in recent years that the increased complexity of Marine operations has projected the image of Marine Corps supply functions from that of a "fly-by-night" operation to that of a highly sophisticated and diverse business.

Provisions for administering supply functions were first initiated by Congress when it reorganized the Marine Corps on July 11, 1798. Section 2 of that act stated that:

> ...And if the Marine Corps, or any part of it, shall be ordered by the President to do duty on shore, and it shall become necessary to appoint a...Quartermaster,... Quartermaster Sargeant, the Major or Commandant of the Corps, is hereby authorized to appoint such staff officer...[1]

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[1] Charles R. Sanderson, "The Quartermaster Department; Its Mission and History," Marine Corps Gazette, Vol XV, No. 1, (March, 1930), p. 61.

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The distinction of being the first supply officer was held by William Ward Barrows, who was also the first commandant of the newly reorganized Corps. He was alloted money from the funds appropriated by Congress and paid all of the Marine Corps bills. One year later, Second Lieutenant Thomas Wharton was appointed the Corps' first quartermaster.

As mentioned previously, history of the supply system was sketchy, but old letters were on record in which the methods of supplying rations and clothing is described. At first, rations were procured by the individuals themselves through money allowances provided by the Corps. To supplement this practice, contracts were made to procure rations as a whole from individuals at an extremely low price, in one instance as low as fourteen cents.[1]

In 1799, the price was standardized at twenty-one and one-half cents and rations were furnished at this price for a number of years. This system was later revised, and a new method, procuring rations by components and supplying the various posts with these components, was initiated by Brigadier General Charles McCawley. This system called for a specified amount of components being furnished daily for each man. A contractor who was awarded the ration furnished the components to the post based on the number of men fed.

The system was revised slightly in the late 1920's, again by General McCawley, to provide some variety in the rations. This system was deemed "thoroughly modern and results in a well balanced ration and good food for the men, provided the cooks are on the job and do their duty".[2]

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[1] Ibid., p. 63.

[2] Ibid.

Under this slightly modified system, the procurement of non-perishable goods (i.e. flour, sugar, canned goods, etc.) was accomplished at Headquarters, or under their direction, and then stocked at the depots located at Philadelphia, Quantico, Parris Island, Hampton Roads, San Francisco, Port au Prince, Guam and Cavite. These goods were then then supplied to the posts upon submission of a requisition. "By this method of purchase the conditions of the market is carefully watched, and a great saving is effected by the timely purchase of all articles."[1]

Local procurement was utilized for the purchase of perishsble goods such as meat, fresh vegetables, and fruit. Contracts were awarded to the lowest bidder in response to local advertisements. The local authority was then responsible for the proper administration of this program.

Records on the history of procurement of clothing, and materials for manufacturing it, are equally vague as those for rations. Some early Marine Corps letters indicate purchases were made from local dealers as the occasion necessitated. It is assumed these purchases were governed by specifications generated by Headquarters.

Manufacture of clothing was done at the Depot in Philadelphia. The earliest records show that the Depot was established in 1857. The Depot was staffed at this time by one officer, a Captain, and five or six enlisted personnel. These men were given the responsibility of supporting a Corps which had grown to 2000 men at this time. The plant was located in a four-story dwelling and completely housed the small supply of materials used in the manufacture of uniforms.[2]

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[1] Ibid.

[2] Howard P. Atherton, "Where Marine Equipment Comes From," Marine Corps Gazette, Vol VIII, No. 4, (December, 1923), p. 238.

Such uniforms as were required were manufactured under contract by commercial houses. All the materials required were purchased and issued to the commercial houses by the Depot. This method was followed until 1879 when the Depot began to cut the materials and gave them out to operators who made the uniforms in their own homes and returned the finished products weekly.[1]

To satisfy the ever-increasing requirements of the Marine Corps, the Depot moved to a new location in 1904 to house its expanding operations. By 1923, seven additional buildings were added to the original structure, and even today some of these same buildings house, in part, the Marine Corps Supply Activity, Philadelphia.

The move was necessitated, in part, by constant commitment of Marine Corps forces from the Spanish-American War in 1898 until the conclusion of World War I. During this period, with the exception of 1913, the Marine Corps was engaged in either a campaign or expedition. All units participating in these engagements were partially or wholly equipped by the Depot. To accomplish this, the Depot was a hub of activity night and day.

In 1909, the Depot began the manufacture of almost every piece of equipment and clothing issued by the Marine Corps. This expansion necessitated the employment of about 1500 people to handle the requirements generated by World War I. During the war, the depot outfitted and equipped thirty-six expeditionary units, including four regiments of 4000 men each. The Depot shipped over 31 million pounds of various supplies during this time.

The Depot consisted of five operating departments in 1923; Inspection, Machine and Motor Shop, Equipment, Clothing, and Woodworking. Each of the production departments was responsible for the manufacture and repair of a wide range of products.

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[1] Ibid.

The Inspection Department was responsible for inspecting all material purchased by the Depot to determine its quality and value. All material had to meet prescribed standards set by Headquarters.

Knives, forks, spoons, mess pans, canteens, and similar objects were manufactured in the Machine and Motor Shop. This department was also responsible for the repair of rifles, typewriters, and automobile parts. In 1923, this section repaired 214,626 articles at a total cost of $147,191.07.[1]

The Equipment Department manufactured leather goods while the Clothing Department's functions were readily apparent. In 1923, this department manufactured 740,860 articles at a cost of $1,288,185.30.[2]

The final department, Woodworking, was initiated in 1908 when the Depot began to manufacture a few packing cases. By 1923, this department was manufacturing field desks, trunk lockers, mess tables, benches and a wide variety of packing cases.

At this time, the net savings to the government on items manufactured at the Depot was estimated at between twenty-five and thirty percent. All personnel in the production department were paid on a piece rate basis, and the manufacturing criteria required articles to be produced at a cost equal to or less than the commercial cost or they would be procured commercially.

In the previous year, 1922, four one-story warehouses were obtained from the Army to handle the surplus supplies. By 1930, the Depot covered a little over two acres not including the four supplementary warehouses.

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[1] Ibid., p. 236.

[2] Ibid., p. 237.

All of the items manufactured at the Depot and stored there and at other depots were controlled by the Quartermaster of the Corps at Headquarters. It was here that the allowance lists, procurement tables, and money allotments were accumulated and dispensed.

The allowance lists, which provided the basis for equipping all units, were prepared and maintained at Headquarters. These lists were compiled from previous years experience and updated as deemed necessary.

The first ordnance supplies of the Marine Corps were loaned by the Army. In 1930, the Bureau of Ordnance, Navy Department, made allowances for the maintenance of large guns. Aviation supplies were furnished by the Bureau of Aviation, Navy Department, while all other supplies came from regular appropriations. Appropriations at this time amounted to about $25 million as compared to the Marine Corps' first appropriations of $50,000.[1]

The scope of the Quartermaster's responsibilities were described in 1930 as follows:

> Provide all military supplies, as well as labor, material and services; purchase, hire, operate, maintain and repair such vehicles as are authorized by the law for transportation of troops and supplies, furnish and forage all public animals, as well as provide forage and stabling for the authorized private mounts of mounted officers; furnish means of transportation which may be needed in the movement of troops and material; shall pay out of the proper appropriations provided for the Corps, all expenses thereof, other than those pertaining to the Paymasters Department...[2]

The Quartermaster General maintained almost complete control of the Marine Corps Supply System until 1942. After this time, the Assistant Chief of Staff, G-4, began to assume more responsibilities in this area. The G-4,

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[1] _Ibid._, p. 239.

[2] Sanderson, _op. cit._, p. 66.

lacking experience in the officers staff, did not expand as quickly as the Supply Department during World War II.

The Supply Department performed admirably during World War II and Korea. Their support of Field Forces "is praiseworthy, particularly since the Quartermaster General of the Marine Corps had to be concerned with the myriad detailed operational problems as a Supply Commander, as well as to plan and provide his own policy guidance as a staff agency."[1]

This fact was the subject of a study submitted by the Assistant Chief of Staff, G-4, to the Commandant in 1954. Basically, this study espoused the position that the G-4 should be responsible for planning and coordination of supply matters, while the Quartermaster General should be concerned with the implementation and execution phases of supply operations. In this same report the Quartermaster General's position was given as follows:

> 4 He stated we should continue as at present on planning stockage objectives to meet requirements for the capabilities and objective plans. He stated these were spelled out in detail by higher authority.
>
> 5 The QMGMC considers it his function to analyze and recommend overall policy on stock management and property accounting.[2]

This point has remained unresolved for the present. The relationship of the G-4 and the Quartermaster General has come under scrutiny many times over the past few years.

The logistical-amphibious doctrine which came out of World War II set the stage for many refinements in the Marine Corps Supply System. The current philosophy called for obtaining required supplies when they are needed.

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[1] "Survey of Logistical Responsibilities and Agencies, Headquarters Marine Corps" (Assistant Chief of Staff, G-4, Headquarters Marine Corps, April 1, 1954), Enclosure (1), p. 41. (Mimeographed).

[2] Ibid., p. 54.

Instead of accumulating vast amounts of supplies on beaches and in the hands of the using units, supply points would be small, self-contained, and widely dispersed.

Pyramiding of supplies throughout the various echelons was to be eliminated by streamlining the supply system so it would be highly responsive to demand.

To provide the responsiveness required, the Marine Corps announced on December 10, 1957 that "within a year it will possess a supply system based on electronic data processing and transmission which will serve Marines throughout the world."[1]

This announcement came at a time when the Marine Corps had an inventory of some 250,000 line items valued at about $1.7 billion. By increasing the efficiency with which this inventory could be managed, these modern management tools were expected to lead to reduced inventories and, consequently, dollar savings.

In addition to developing current data on inventory status, the equipment, of which the Remington Rand's Univac Computer was the major component, compared actual balances against predetermined levels and printed out stock status information on only those items requiring management action. This 'management by exception would permit stock reviewers to devote more attention to areas requiring management action'.

The first computer was to be installed at Albany, Georgia. The master control point for the system was to be Philadelphia. Also tied into the network were Camp Lejeune, N. C., Camp Pendleton, California, Parris Island, South Carolina, San Diego, and Barstow, California.

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[1] U.S., Department of Defense, "Marine Corps Installing Electronic Supply Systems Records," (Office of Public Information, Department of Defense, December 10, 1957).

These first computers utilized magnetic tapes as memory units and can be read at the rate of 75 inches per second; 300 punch cards can be read and directed to proper storage in one minute; 78,000 additions or subtractions can be calculated in one minute, 5000 multiplications or 3700 divisions per minute; 138,000 logical decisions in one minute; and they had a print out capability of 600 lines per minute. Although other services had installed electronic computers prior to this time, the Marine Corps was the first to attempt an integrated computer system which tied in all components of the complete supply system.[1]

To more effectively utilize the advantages of electronic data processing, the Marine Corps exerted maximum effort to revising its current system into a program in which manpower and material resources would be integrated into a single, homogeneous, and streamlined supply management system. Such a system would be designed to incorporate modern business and inventory management techniques.

Prior to this time, the Marine Corps supply system had been divided into five semi-autonomous subsystems, each sharing total supply management responsibility along the traditional commodity lines (i.e. ordnance, motor transport, engineer, communications-electronics, and general supply). Each system enjoyed virtually independent management policy control and operated within its own framework of supply control policies, organization, and procedures. These separate systems reflected in many ways the various supply systems of the technical bureaus, and commands of the other three services from which the Marine Corps procured the bulk of its hardware/weapons material.[2]

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[1] O. R. Lodge, "Automation in Supply", Marine Corps Gazette, Vol 43, No. 4, (April, 1959), p. 35.

[2] Ion M. Bethel, "How the Marines are Solving their Modern Supply Problem," Armed Forces Management, Vol. 4, No. 7, (April, 1958), p. 36.

The first step taken to streamline the existing system was to destroy the organizational structures supporting the five individual systems. This was accomplished by first replacing the commodity management at departmental and field level with a functional organization which embraced the total range of materials required to support the Fleet Marine Forces and place it under common management direction.[1] Two control points were established to provide the supply and inventory control essential for such an integrated supply system -- Headquarters, Marine Corps and the Marine Corps Supply Activity in Philadelphia. Major items were to be controlled by Headquarters, Marine Corps, while Philadelphia would have the responsibility for controlling all secondary items.

To provide true integration of material inventories and sound supply management, a single stock numbering system was required. The answer was found in the Federal Cataloging Program. The Federal Stock Number provided an efficient means for management categorization of inventories. Both stock and financial reporting systems were converted to Federal Group and Class Reporting. By using the Federal Supply Classification as a standard module the collection of inventory management data to insure responsiveness was both flexible and efficient.

Management of inventories was based, and still is, on the fundamental precept that the consumer determines the levels of material inventories required to support himself. Actual usage history replaced theoretical consumption rates in computing stock levels. Frequent review was utilized to insure adjustment of levels as the demand varied. Inventories were

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[1] _Ibid._, p. 37.

separated into strata by purpose on the basis of repetitive demand information and divided by rate of turnover and dollar value to reduce system assets to a minimum. This identified excesses and permitted speedier redistribution or disposal. In this way, greater utilization of personnel and funds was accomplished without compromising efficiency or effectiveness.[1]

Any material coming into the system was carefully controlled to insure against excesses or compensate for existing shortages. Standardized provisioning techniques were adopted in all equipment areas to concur with end item production. Repair parts, components, and other maintenance items were catalogued and processed to determine the range and quantity to purchase. The range was limited to items not presently within the supply system, or those that could not be purchased more economically from some other source. Quantity was to be determined by usage of the respective end items as well as the tactical maintenance concepts under which they were to be operated.

The streamlined system and introduction of automatic data processing were predicated on the introduction of the Single Line Item Transaction (SLIT) Card in 1958. This was the vehicle which permitted a conversion from the Marine Corps mechanized supply system initiated in 1952 to the more modern automatic data processing. The SLIT card, through a technique of coding, provided all the basic data required to perform material or inventory accounting, cost accounting, and fiscal accounting.

April of 1961 saw the advent of more streamlined procedures which required less manual review. The system remained essentially the same as that developed during 1958-1959.

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[1] Ibid.

This was the supply system which the Marine Corps was to retain until the implementation of the Marine Corps Material Management System in 1967. A study by the Supply Department in 1962 described the system as follows:

> The Marine Corps has developed a multiple echelon logistics system designed to relieve each succeeding lower echelon of as much operational detail as possible. It is essentially an automatic "push" system geared to position material as possible to the consumer echelon. The Marine Corps Supply System consists of all supply elements within the Marine Corps. The major elements of the Marine Corps Stores System include two Inventory Control Points, two Supply Centers and seven Stock Accounts, Additionally, the Stores System embraces designated individual clothing accounts, commissary stores accounts, designated non-mechanized subsistence accounts, and ammunition accounts comprised of Marine Corps-owned ammunition stocked at Naval Ammunition depots.[1]

This same study focused also on the functions of the Marine Corps Supply System and they identified six areas of supply, managerial, operational, and technical concern:[2]

1. To compute material requirements;

2. Procurement, warehousing, distribution, shipment, repair, issue, sale and control of all equipment, materiel and supplies for the Marine Corps;

3. Accumulation of data for supply management and analysis to include the development of accounting and reporting systems;

4. Procurement and administration of all services required by the Marine Corps;

5. Preparation and control of all budget estimates and allotments for programs under the direction of the Quartermaster General;

6. Participation with Department of Defense and its agencies in supply management projects.

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[1] "Study for the Determination of the Posture of the Marine Corps Supply System within the Department of Defense" (Supply Department, Headquarters Marine Corps, Study No. 3 - 1962, 1962), Appendix (3), p. 1.

[2] Ibid., pp. 1-2.

To accomplish these functions, the system is structured as a pyramid with the Inventory Control Points at the apex and the using units at the base. Requisitions are passed up through the layers of the pyramid until filled or an obligation is established. A more descriptive picture of this process and the system structure is given in Appendix A.

The first element in the supply chain is the Service Battalion which is organic to each Marine Division and is responsible for direct supply support for the division. It is equipped with a mobile data processing capability which enables it to issue supplies, update requirements, and automatically order supplies from the Stock Account.

As the next step in the Supply chain, the Stock Account is little more than extension of the Supply Center, located at key areas to provide more accessibility to the supported units. Conventional offset tabulating equipment, and in some cases 1401 computer systems, is utilized for record-keeping purposes. Transactions which have any effect on inventories are transceived to the computer of the supporting Supply Center. The accumulation of these data by the Supply Center permits automatic resupply. Stock Accounts do not have any machine capability of computing requirements which necessitates a "push system" by the Supply Center for centrally managed items.

The real "heart" of the Marine Corps Supply System at this time was the Supply Center. It is from here that the coastal complexes are controlled. The Supply Centers maintain a separate inventory record for each Stock Account, holding assets or usage history for every item stocked. The computer system also provides for automatic monitoring of Stock Account records to insure efficient performance and compatibility with existing guidelines.

In addition, the Supply Center has the capability of consolidating inventory data for the entire Complex and submitting these data to the Inventory Control Point where they can be further consolidated. Updating of Complex records is done on a thrice weekly basis. Initially, changes in inventories were reported to the Inventory Control Point on a monthly basis but this was changed to semi-monthly to provide a more responsive system.[1]

At the top of the supply chain are the Inventory Control Points at Philadelphia and Headquarters, Marine Corps. Only Philadelphia has a computer capability and, therefore, must do accounting for both.

The ICP maintains consolidated records for the overall supply system and computes requirements by selection and application of the program to which an item has been coded. The Economic Order Quantity formula and the variable safety level are emphasized but days of supply, cyclic purchases and shelf-life are also considered as factors.[2]

As the central control point, the ICP is responsible for maintaining predetermined levels of supply throughout the system and locating supplies to provide optimal responsiveness for its day-to-day operations.

The Supply Study conducted in 1962 enumerated what it felt were some of the major advantages of the current system:

> Centralized control of all operating stocks by means of the Inventory Control Points and their ability to consolidate and evaluate inventory and fiscal information...
>
> ...A "Push" system designed to position stocks for the greatest advantage of operating forces...

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[1] *Ibid.*, p. 5.

[2] *Ibid.*, p. 7.

> ...The ability to accumulate data and produce accurate up-to-date inventory and fiscal data to support budget formulation and for procurement requirements...
>
> ...Better customer service provided with reduced inventory...[1]

The formulation of policy for the Marine Corps Supply System is generated from Headquarters, Marine Corps. Ultimate responsibility for policy formulation was, and still remains, clouded by the overlapping activities of the Quartermaster General and the Assistant Chief of Staff G-4.

There have been numerous studies on how to resolve this conflict but none have, as yet, been adopted. A board organized to investigate reorganization of Headquarters, Marine Corps in 1962 recommended placing the responsibility for the Supply System under a Director of Installations and Logistics as shown in Appendix B. The Supply Division of this department was envisioned to have the following mission:

> The Chief of the Supply Division is responsible for the Marine Corps Supply System including the Marine Corps Stock Fund, for establishing policy governing the Marine Corps Supply System; for providing for the procurement, technical support, inventory and warehouse management, financial and item accounting, system design and analysis, and disposition of all types of supplies and equipment; for detailed development of the budgets for the appropriations Procurement Marine Corps, Marine Corps Stock Fund, and designated projects of Operations and Maintenance Marine Corps.[2]

The Supply Department Organization which was adopted, although it did not consolidate the functions of the G-4 and Quartermaster General under one division, nevertheless, resembles the structure of the proposed organization along functional, if not organizational, lines. It was ultimately organized into seven divisions and four offices as shown in Appendix B.

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[1] *Ibid.*, p. 8.

[2] Report of the Headquarters Marine Corps Reorganization Board (Headquarters, Marine Corps, August, 1961), Appendix (1), Chart 13A-2, p. 1.

To present some idea of the scope of operations which this supply system was supporting, we only need look at the table shown below. This depicts, by materiel categories, the number of line items which are maintained in the Marine Corps Stock Fund. The Marine Corps Stock Fund which was established in 1953 under authority of the National Security Act of 1947 and is controlled at the ICP in Philadelphia, financed approximately 312,000 line items in 1965; or 98% of the total number of line items in the Marine Corps in 1965.[1]

TABLE 1

MARINE CORPS STOCK FUND

CATEGORY	LINE ITEMS
General Property	114,600
Communications/Electronics	90,839
Automotive	52,028
Engineer	44,909
Other	10,050

Even with the high degree of effectiveness enjoyed by this system it was becoming obvious that external developments, such as emerging Department of Defense Management philosophies and even greater advances in computer technology, would render the present system obsolete in the not too distant future. It was for this reason that two task groups were formed during the years 1963-64.

The development of the Marine Corps Supply System had come a long way since the day when the Commandant of the Marine Corps was his own

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[1] The table which follows was presented in a speech given by the Quartermaster General of the Marine Corps in 1965.

supply officer. Sophisticated weapons systems require sophisticated management techniques to provide responsive support. The Marine Corps was now preparing itself to take a giant step forward to insure such support would be available

IV. TRANSITION TO MUMMS

The Task Force, which was delegated the responsibility of revising the present supply system, took a great deal of factors into consideration. Their main concern was to develop the conceptual framework for the new system, and to do this they first had to make certain assumptions and also establish prerequisites for the system.

Among their assumptions were those that the Marine Corps would continue to retain complete control of its own supply system from top to bottom; that the structure and mission of the Marine Corps would remain essentially unchanged; that the trend toward centralization of control and uniformity of policy would continue within the Department of Defense. In addition, it was anticipated that such a system would keep pace with technological advances in data processing as well as improved supply management techniques. The final, and perhaps most important, assumption was that military services would only be allowed to retain supply organizational components which are being economically and efficiently utilized.[1]

The prerequisites which the group formed for such a system encompassed ideas such as "...economical use of resources", "compatible with externally developed systems", "optimum use of modern data processing equipment and management techniques", and "integration of related logistic and fiscal management requirements". Two primary considerations in this respect were,

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[1] Report of Committee to Develop Supply System Organizational Structure, (Headquarters, Marine Corps, 1964), pp. 2-3.

of course, effective supply support for the using units as well as the ability to make a rapid and effective transition from a peacetime to a wartime support role.[1]

The development of a system based on the above mentioned assumptions and prerequisites was viewed as depending on two sets of influences -- those external to the Marine Corps and also internal influences. For purposes of the report the external influences were divided into five categories: (1) Command Relationships, (2) Tactical Requirements, (3) Department of Defense Materiel Management Trends, (4) Department of Defense Financial Management Trends and (5) Advanced Supply Management. Internal influences were likewise categorized into five areas: (1) System Considerations, (2) Personnel, (3) Budgetary Considerations, (4) Impact of Modern Weapons, and (5) Existing Organizational Structure.

External Influences

Under the area of command relationships, the major trend considered was that towards greater centralization within DOD. The group felt this would continue and would be a major force in the determination of the system structure.

There also appeared to be a trend toward standardizing procedures on a departmental level. Audit reports from the General Accounting Office at this time consistently recommended universal authority and functions to the Defense Supply Agency.

Also to be taken into consideration was the implementation of the Military Standard Requisition and Issue Procedures (MILSTRIP) and the

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[1] *Ibid.*, p. 4.

Military Standard Transportation and Movement Procedure (MILSTRAP). The Marine Corps was allowed to delay internal implementation of these two programs initially, but any future system would have to prove compatible with their requirements.

In addition to these two procedures, the Supply Department Study No. 3-1962 indicated a number of developments within DOD which would place requirements on the Marine Corps Supply System: (1) Additional Integrated Manager Assignments (i.e. General Supplies, Industrial Supplies, Construction Supplies, and Automotive Supplies); (2) Establishment of the Defense Supply Agency (DSA); (3) DSA Distribution System Study;[1] (4) DOD Study on Application of Automatic Data Processing in Defense Materiel Management.

The area of financial management within DOD also had strong implications for consideration of a new system. Of particular impact among these are the Five Year Defense Plan (FYDP) and the concept of planning, programming and budgeting.

The rapidly changing area of supply management, both equipment and techniques, requires that great care be exercised in selection of the system to avoid premature obsolescence.. Therefore, the equipment and techniques which the system would require for maximum effectiveness would have to be precisely identified.

From the equipment standpoint a major consideration would be the utilization of a real time system and a remote processing capability. Particular care would be required to determine such techniques as the use of Economic Order Quantity formula. The formula would include usage history, rate of obsolescence and cost of ordering, inspecting, shipping, receiving,

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[1] This study called for the phasing out of the Marine Corps Supply Centers from the Defense Supply Agency wholesale distribution by the end of Fiscal year 1964.

storing, and paying for materiel. Some of these factors were currently being used but were fixed; some were computed but not updated; and others were not used at all.

The accumulation of data such as this would permit examination of: accuracy of lead time and the probability of variation; accuracy of and probability of variation in usage data; the cost of carrying safety stocks; and the cost of stock-outs. These and other inventory management techniques would have to be utilized to ensure that minimum inventories to support the mission are on hand and that maximum use is realized from the available material.[1]

Internal Influences

One of the chief drawbacks to the current system was an apparent lack of command awareness. Although the fact that supply was a function of command was accepted, the interest was not there. In addition to this, it was not uncommon for people to view the supply system as being confined to the higher echelons and not encompassing the using units. This was a factor which must be considered in devising a new system.

Along this same vein is the lack of an effective means of evaluating performance and taking remedial action where necessary. Attention has been directed primarily to materiel input to the system with little concern for the effectiveness with which supply management was being practiced on the consumer level. The two would have to be integrated to provide an efficient and responsive system.

Personnel was another concern which had to be dealt with. Adequately trained personnel would have to be found or schooled in order to manage a system with any degree of consideration.

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[1] Committee to Develop Supply System, p. 27.

The emphasis on cost analysis of systems placed the Marine Corps in a position of competition with other services for budget considerations. This fact compels that an efficient supply system be maintained to prevent the drain of funds to the detriment of the combat/military capability of the Marine Corps.

Complex modern weapons presented a problem to supply management and the new system would have to make allowances for this. There was some pressure favoring project management of such weapons systems. It was felt by the group that problems existed because of the lack of carefully coordinated planning action. This could be eliminated by specialized and periodic parts status reporting for each major weapon. Although the present system provided for stock managers for these weapons systems, neither current manpower nor the management information design of the current system permitted optimum use of advanced management techniques.[1]

Of major concern in the current organization of the supply system was the increasing obsolescence of the Supply Center as well as the duplication of effort resulting from the two Inventory Control Points. With the Defense Supply Agency assuming responsibility for managing and distributing Marine Corps items on an expanding scale, the scope of Supply Center operations was decreasing to what might be only 10 to 25% of all items used in the Marine Corps. It was necessary to take a long hard look at the mission of the Supply Center and its future role in the Marine Corps.

On the heels of the report submitted by this first group, a second Task Force was formed to determine the feasibility and desirability of

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[1] _Ibid._, p. 37.

implementing a supply system concept in conjunction with the implementation of MILSTRIP/MILSTRAP. Members of the group represented each of the functional areas associated with an inventory/financial management system, including data systems analysts.

This Task Force endorsed the new system as proposed by the previous study. They then initiated proceedings to develop specifications for the new system. The development of data sufficient to analyze the performance of the system was, from the beginning, a basic requirement in the system design. The magnitude and complexity of the new system required a focal point for the collection of useful information and the construction of meaningful management reports. This was accomplished by incorporating a subsystem within MUMMS to perform this function.

Actual development of data systems specifications for MUMMS commenced in January of 1964. By utilizing data systems engineers/analysts as part of the Task Force, a better understanding of systems requirements could be developed, communication barriers could be eliminated, and terminology clarified to ensure that the specifications were truly compatible with the system design. This study continued throughout the year and the system was approved in December of 1964.

These specifications were developed to provide a centrally controlled system to ensure more effective management, an improved response to requisitions through centrally managed assets, elimination of the echelons of record keeping to reduce the complexity of accounting, and more effective use of personnel and equipment by reducing duplication and clarifying responsibilities. To accomplish it, it would be necessary

to make extensive use of automatic data processing coupled with a facility for rapid communications.[1]

Responsiveness was the paramount feature of the system concept. It required that requisitions be relayed through the system unencumbered by data processing backlogs. This necessitated a computer capable of storing all the data required for one or more applications and to make them available at random for reference or modification purposes without resorting to batch and processing on a cyclic basis.[2]

To ensure that the basic features described were adequate to solve the problem the Task Force made a detailed analysis of the logistic responsibilities assigned to the Marine Corps Supply System. For purposes of data control, it was decided to divide these responsibilities into major subsystems integrated into the overall system concept. Having delineated the subsystems, a study was conducted to find data requirements and the method of processing data, batch or direct access, which best suited the individual manager's needs.

Files, the number of files, and the number of records were also the subject of further study. In the case of direct access files, the study was made to determine the file name as well as record length and volume and file characteristics.

The determination that such a system would function was the culmination of approximately two years of studying and analyzing this problem. This decision was based on the judgment of specialists in the fields of supply, logistics, financial, and data systems.

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[1] U.S., Department of the Navy, Headquarters United States Marine Corps, System Specifications for the Marine Corps Unified Materiel Management System (Washington, D. C., Headquarters Marine Corps, November, 1964), p. 01-8.

[2] *Ibid.*, p. 02-2.

Another consideration in determining the system specifications was the ability of the vendors to determine the equipment configuration which would best meet the system requirements. The specification of data and the method of presentation were undertaken to best assist the vendor in determining these configurations.

Vendors were allowed to supplement their proposals with oral presentations. In addition, any written questions were answered if received in the first 75 days of the 90 day proposal period.

The Data Systems Specifications, RFP 001-64, were presented to all interested vendors at a conference held at Headquarters, Marine Corps, on December 30, 1964. Vendors were notified of this conference based on a list of all known and qualified vendors prepared by the Special Assistant to the Secretary of the Navy and forwarded to the Marine Corps. Based on this list and one addition received by a memorandum from the Special Assistant to the Secretary of the Navy, the following vendors were solicited:

TABLE 2

VENDORS CONTACTED FOR MUMMS

Addressograph-Multigraph Corp.
Advanced Scientifics Instruments
Burroughs Corporation
Control Data Corporation
Digitronics Corporation
Friden, Inc.
General Electric Company
General Precision
Honrywell, Inc.
International Bussiness Machines
Monroe International, Inc.
Auerbach Corporation
National Cash Register Company
North American Aviation, Inc.
Philco Corporation
Radio Corporation of America
Scientific Data Systems, Inc.
Stromberg Time Corporation
Smith-Corona Marchant, Inc.
Sylvania Electronics Products, Inc.
USS Instruments, Inc.
Univac Division, Sperry Rand Corp.
Visirecord Company
Underwood Corporation
Acme Visible Records
Computronics, Inc.

Source: Unpublished reply to Congressional inquiry concerning the implementation of MUMMS, 1968.

All of those solicited responded in some manner with the exception of those listed below:

TABLE 3

VENDORS NOT RESPONDING

Acme Visible Records, Inc.	Scientific Data Systems, Inc.
Computronics, Inc.	Digitronics Corporation
Friden, Inc.	Smith-Corona Marchant, Inc.
Monroe International, Inc.	Stromberg Time Corporation
Underwood Corporation	Visirecord Company

Source: Unpublished reply to Congressional inquiry concerning the implementation of MUMMS, 1968.

Only three of the twenty-seven vendors solicited submitted proposals. These were International Business Machines, Inc., Radio Corporation of America, and Univac Division, Sperry Rand Corporation.

The cost to the government of the equipment and services required to analyze the specifications, validate the vendors proposals, and select the equipment was expected to be about $53,000. Of this figure, $30,000 was to be used for the preparation of evaluation procedures by a commercial contractor.

Extreme care was exercised to insure that the specifications were sufficiently detailed to provide the vendors with an adequate basis for preparing their proposals. For this purpose, the specifications set forth mandatory requirements which had to be discussed in each proposal.

Among these requirements were the following:

(1) System compliance which required the proposal to demonstrate the capability of the proposed equipment configuration to meet the total system processing requirement;

(2) Completely process the workload prescribed;

(3) Compatibility between configurations at different locations and program language (COBOL 61 Extended);

(4) Equipment, including input/output devices, must have been announced for market purposes and exist in at least prototype form;

(5) Must be capable of direct interface with the Automated Digital Network (AUTODIN);

(6) Immediate access storage;

(7) Must be capable of accommodating remote input/output devices with no modification;

and (8) Software must include Soft/Merge Generator, Executive Routine, and COBOL.[1]

Although the specifications were presented in detail, considerable effort was expended so as not to stifle vendor competition by introducing too detailed constraints. The vendors conference was held to offer the vendors a chance to ask questions and they were encouraged to do so.

During March of 1965, the Marine Corps formed an Equipment Selection Committee. This committee was to examine all proposals to ensure they would be adequate for the purpose and, also, to monitor the costs involved to ensure they were reasonable.

This committee relied heavily upon information provided by a validation team in accordance with rules and procedures established by the Auerbach Corporation of Philadelphia. The validation team which supplied the needed information was composed of a project manager and 18 data systems engineers, analysts, and programmers.To provide for a more through analysis, the team was subdivided into groups to study specific aspects of the system proposals: remote storage devices, adequacy of proposed central processing unit memories, feasibility of on-line system including AUTODIN interface, batch systems and timing, cost capacity data, equipment reliability, and software analysis.[2]

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[1] Ibid., pp. 01-8 to 01-10.

[2] Reply to Congressional inquiry concerning the implementation of Materiel Management Systems within the Department of Defense, 1968.

letter of December 30, 1964 was included with the RFP to describe an additional requirement:

> In addition, it is intended to require the vendors who submit proposals to program and demonstrate the capability of their equipment to accomplish the data processing functioned in this RFP. The demonstration will require programming of the processes specified below to indicate throughout speed and access time for records of similiar length.
>
> The demonstration must be accomplished on a configuration of identical speed and capacity to that recommended by the manufacturer. Positive blockouts of excess memory, special devices, input/output equipment, etc. will be used, as required, on the demonstration hardware.[1]

Tests to be performed were to be based on a benchmark problem which was set forth in this same letter of December 30:

> The "benchmark" problem will consist of the following:
>
> Two reels of tape from each of the two complex inventory files will be provided for each vendor. These tapes must be converted from the present UNIVAC III mode to the new consolidated record format of the Master Inventory File described in attachments 03 of this RFP. The new converted and consolidated records will be loaded in the direct access mode storage offered by the vendor. The tapes will be available at the vendors' request on 15 January 1965 to allow sufficient time to test conversion programs.
>
> A demonstration of throughput speed and random access times will be required by the processing of 2000 transactions in a prearranged sequence, accessing the appropriate record in direct access storage, and printing all or portions of the record as specified by a transaction code in the input. Punched cards containing 2000 Federal Stock Numbers will be provided for test purposes along with tape files. When the actual demonstration is performed another 2000 transactions will be delivered to the vendor in a prearranged sequence. The demonstration must accept the transactions in the prearranged sequence access the Master File in the same order and perpetuate the sequence in the printed output.[2]

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[1] Letter from the Commandant of the Marine Corps concerning System Specifications for MUMMS, December 30, 1964.

[2] Ibid.

Further detail on the benchmark problem was furnished to the vendors in an another letter on January 14, 1965. In addition, several letters were issued during the negotiations to clarify the problem or to answer inquires of the vendors.

The results of the benchmark problem showed that only IBM completed the problem with no difficulty. UNIVAC also completed the problem but had difficulty with a program loop. RCA, on the other hand, failed to complete the problem.

The first hardware, the IBM 360 series, was installed at the Inventory Control Point in Philadelphia, where the centralized design and computer programming was conducted for the entire system. Prior to implementation, the use of equipment at this location was devoted entirely to testing MUMMS applications programs and conversion of data from the old to the new supply system.

After these tests were completed, the programs were completely debugged and approved computers were delivered to other activities. Albany, Georgia, Camp Lejeune, North Carolina, Barstow, California, and Camp Pendleton, California received their hardware during July of 1966. Quantico, Virginia, 29 Palms, California, and San Diego, California, had their equipment installed in November of 1967. The ninth, and final, system at Parris Island, South Carolina, is scheduled for installation during March of 1968.

At this time, all of the design and development stages had been completed. Implementation took place on May 1,1967, and is completed, although not in the fashion desired. The computer equipment at the Inventory Control Point was not adequate to support the system, and

commercial time was required to meet requirements. Replacement of this equipment with larger hardware was approved and it was installed during January of 1968. Commercial time was utilized for the processing of certain files not directly related to the processing of requisitions.

The major setback from planned progress to the actual progress was caused by the delay in implementing the system. This delay resulted partly from the unplanned escalation of the war effort in Vietnam and the subsequent emphasis on maximum supply support for deployed forces as well as the activation of new organizations which required initial outfitting and provisioning.

As was mentioned previously, the system was of greater scope and sophistication than anything ever attempted before by the Marine Corps. This meant there were no prototypes or background experience from which progress or forecasts of future actions could be tested.

This complexity, then, along with the adoption of the "real time" approach to inventory management, placed a great strain on the available resources. In view of this, it was decided to retain the current support capability until the availability of a replacement system with proven reliability.

The following tables will give some idea of the cost of designing and installing the system, and the total estimated cost to complete. In addition, the Marine Corps, at the beginning of fiscal year 1969, purchased the equipment at the first five locations listed in Table 6. The costs of this equipment is shown in Table 7.

TABLE 5

COST OF ANALYST/PROGRAMMER RESOURCES

ACTIVITY		MAN HOURS*	COST*
MUMMS/ICP		400,000	1,600,000
MUMMS/RSA		50,000	200,000
Financial Systems		27,600	110,400
Analyst/Programmer Training		168,000	673,920
	TOTAL	645,600	2,584,320

* Based on average labor rate of $4.00/hr for a predominatly military work force.

Source: Unpublished reply to Congressional inquiry concerning the implementation of MUMMS, 1968.

TABLE 6

RENTAL COSTS FOR ADPE
(Delivery Date to June 30, 1967)

ACTIVITY	DELIVERY DATE	BASIC MONTHLY RENTAL	TOTAL RENTAL
MCSA-Philadelphia	Feb. 1966	$40,956	$598,225
MCSC-Albany	July 1966	45,456	520,428
MCSC-Barstow	July 1966	24,889	150,266
MCB-Camp Lejeune	July 1966	17,504	147,944
MCB-Camp Pendleton	July 1966	17,344	145,368
MCS-Quantico	Nov. 1967	16,867	---
MCRD-San Diego	Nov. 1967	16,867	---
MCB-29 Palms	Dec. 1967	16,867	---
MCRD-Parris Island	Mar. 1968	16,867	---
		TOTAL	1,562,231

Source: Unpublished reply to Congressional inquiry concerning the implementation of MUMMS, 1968.

TABLE 7

PURCHASE OF EQUIPMENT

	COST
Purchase Price (New)	6,470,285
Rental Credits	1,028,285
Purchase Option Deposit	62,942
FY 1968 Purchase Price	5,379,058
Modification of Purchased Equipment	484,230
Total Purchase Price	5,863,288

Source: Unpublished reply to Congressional inquiry concerning the implementation of MUMMS, 1968.

TABLE 8

COST OF DESIGN AND INSTALLATION
(through December 1967)

SOURCE		COST
Analyst/Programmer Resources		2,584,320
Total Marine Corps Rental, to June 1967		1,562,231
Commercial Rental, April-June 1967		318,300
Commercial Rental, July-December 1967		450,000
Total Purchase Price		5,863,288
	TOTAL	10,778,139

Source: Unpublished reply to Congressional inquiry concerning the implementation of MUMMS, 1968.

In accordance with a Secretary of the Navy instruction, a Task Force was convened in August 1967 to evaluate the equipment which had been purchased and installed. This review was expanded somewhat to include the data processing requirements of the entire establishment within the United States. This was keeping in line with the Marine Corps policy to consolidate functional applications at its computer installations for economy reasons.

The Task Force felt that the equipment selected had been sufficient at the time of selection, but the system had grown beyond its initial limits to an extent the equipment could no longer adequately support it. Among the factors contributing to this expansion was the increasing support requirements generated by the escalation of hostilities in Vietnam, and also the impact of new DoD programs such as MILSTRIP, MILSTRAP, MILSTEP, MILSTAMP, and others was becoming more clearly defined.

In addition to this, there had been no excess capability provided in the initial equipment to support new impending programs such as the Joint Uniform Military Pay System (JUMPS) and Resource Management System. Concurrently, no capability had been provided to absorb the load which would result from supporting an additional division/wing team in the event the reserves were mobilized.[1]

In light of these facts, the Task Force concluded the equipment was inadequate, They, in turn, recommended an upgraded configuration with the cost of such equipment to be accrued to the cost of implementing the system.

Equipment which had already been purchased was redistributed to activities to replace rental equipment where configurations permitted. This was not a considered disadvantage since, in many cases, smaller configurations were replaced with larger ones, and the ultimate result would be the elimination of all rental equipment.

At this time the software system was a customized Basic Operation System maintained by Marine Corps and IBM system engineers, and known as

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[1] Unpublished reply to Congressional inquiry concerning the implementation of MUMMS, 1968.

the MUMMS Operating System (OS). The Marine Corps felt it would be more advantageous to switch to a standard vendor supported operating system. This would take advantage of new direct access methods, multiprogramming, new and improved direct access storage, input/output devices, and the myriad of changing requirements.

The transition to this system is expected to be completed during fiscal year 1970. The system will consist of the Disk Operating System (DOS) and the Operating System/360 (OS/360). This increased sophistication and responsiveness of the software system, as well as the larger hardware configurations, was expected to enable the Marine Corps to realize the long range objectives of the system.

The table below shows the expected costs of upgrading and refining the system:

TABLE 9

UPGRADING AND REFINING COSTS

Continued Commercial Rental to eliminate processing backlog, pending upgrading of equipment (3 months at $75,000) (3 months at $35,000)	330,000
Manhours required to transfer to DOS and OS/360 (100,000 hrs at $4.00/hr)	400,000
Site preparation for enlarged ADPE configuration during FY69 - MCSA, Philadelphia	163,000
Total Annual rental - MCSA, Philadelphia, FY69	1,121,790
Total Annual rental - MCSA, Philadelphia, FY70	1,308,876

Source: Unpublished reply to Congressional inquiry concerning the implementation of MUMMS, 1968.

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[1] Unpublished reply to Congressional inquiry, concerning the implementation of MUMMS, 1968.

Sometime during Fiscal Year 1970, the system is expected to have reached its peak as regards design and implementation. Considering this, funds in the amount of $4,119,345 have been budgeted for the purpose of purchasing the equipment at Philadelphia at the beginning of Fiscal Year 1970. If approved, this would eliminate the rental charge of $1,308,876 shown in the table above. From this point on on it is expected that the system will accrue maintenance costs only.

Even though the predecessor to MUMMS was highly automated, the transition was not an easy process. The design and implementation required a great deal of expense, both in manpower and materiel.

The setbacks encountered along the way were overcome through a great deal of hard work. It required coordination and cooperation at all echelons of the supply system to get it off the ground.

The system was no longer a dream but a reality. The postponements in the implementation date resulted in a great deal of skepticism among Marine Corps personnel. Beginning May 1, 1967, however, judgment of the Marine Corps Supply System would be based on operating results and not expected results. It would sink or swim on its own merits rather than the conjecture which preceded its arrival.

V. MUMMS

On May 1, 1967, the long awaited switch to the Marine Corps Unified Materiel Management System was finally made. The work of a multitude of system analysts, engineers, and programmers was at last a reality.

The system when it finally came into being was designed to bring under one roof all the activities which determined procurement, storage and control, as well as disposal, of the entire materiel assets of the Marine Corps. System management was to eminate from the Inventory Control Point and be exercised through the Remote Storage Areas (RSA's). To accomplish the degree of responsiveness desired, as well as complete administration of the distribution system, sixteen subsystems were established to carry out the assigned tasks of MUMMS.

The subsystems have number identifiers from 02 through 17 and are listed below in their proper order from top to bottom. A description of the individual subsystems will be presented later in this chapter.

Data Control
Inventory Control
Stores Accounting
Automated Procurement
Mechanization of Warehousing
and Shipment Processing
Direct Support Stock Control
Technical Data Management
Applications
Provisioning
War Reserve
Depot Maintenance Management
Controlled Item Management
Budget Data
Special Programs
Supply Management Information
Automated Allotment Accounting

The Inventory Control Point (ICP) for MUMMS was established at the Marine Corps Supply Activity at Philadelphia. This site was picked to

facilitate the transition to MUMMS, as Philadelphia had housed the bulk of the central management processes, including data processing, under the old system. It was also expected that a single ICP would eliminate some of the duplication of effort which existed under the previous setup which had two ICP's.

Among the functions of the ICP is the processing of all phases of the Marine Corps logistics effort as it concerns the input, availability, and issue of materiel. In addition, the ICP is responsible for the technical direction of all RSA's. The subsystems listed previously are the means by which the ICP carries out these responsibilities.

To provide for continuous supply support for Marine Corps forces throughout the world, MUMMS has provisions calling for an Alternate Inventory Control Point (AICP). The AICP for the Marine Corps is located at the RSA at Albany, Georgia.

If the ICP is not capable of performing its central processing functions, regardless of the reasons, this responsibility will be transferred to the AICP. Transfer of responsibility, should it occur, will be coordinated between the two locations and submitted to the Commandant of the Marine Corps for final approval. To accomodate a transfer, the RSA at Albany was given the same equipment configuration as that at Philadelphia. A transfer of responsibilities would not effect the processing of three subsystems (Mechanization of Warehousing and Shipment Processing, Direct Support Stock Control, and Depot Maintenance Management) which are currently being processed at the AICP.

Should a transfer of responsibility take place, the ICP would insure that programs and data be made available to the AICP so its records

could be updated. In addition, personnel who are familiar with the various subsystems will be temporarily transferred to the AICP.

The Remote Storage Areas are an integral part of the overall supply system. Basically, they have the responsibility of storing and shipping all materiel held by the Marine Corps as well as all 5th Echelon Repair and Rebuild Programs at the RSAs at Barstow, California and Albany.

Command of the RSA is vested in the commander of the base at which the RSA is located and his range is absolute with the exception of technical matters which have a bearing on the supply system. Such technical matters come under the control of the ICP commander in Philadelphia.

To insure this, liaison is maintained between the RSA and ICP regarding base support requirements which effect the RSA's ability to fulfill its mission in the overall supply system. Should the two be unable to resolve any problems, they will be referred to the Commandant for a decision.

System Interface and Operation

The subsystems of MUMMS and their relations to the other subsystems, as well as Department of Defense systems, are shown on Chart 1 on the following page. The key link for the subsystems within MUMMS is the communication network of AUTODIN. AUTODIN not only links the subsystems, but ties MUMMS into the overall DoD network to such activities as Defense Logistics Service Center and Defense Supply Center, as well as the other military services. In this way MUMMS achieves total integration of the 16 subsystems, and data are available for transfer from one subsystem to another for the preperation of reports and documents.[1]

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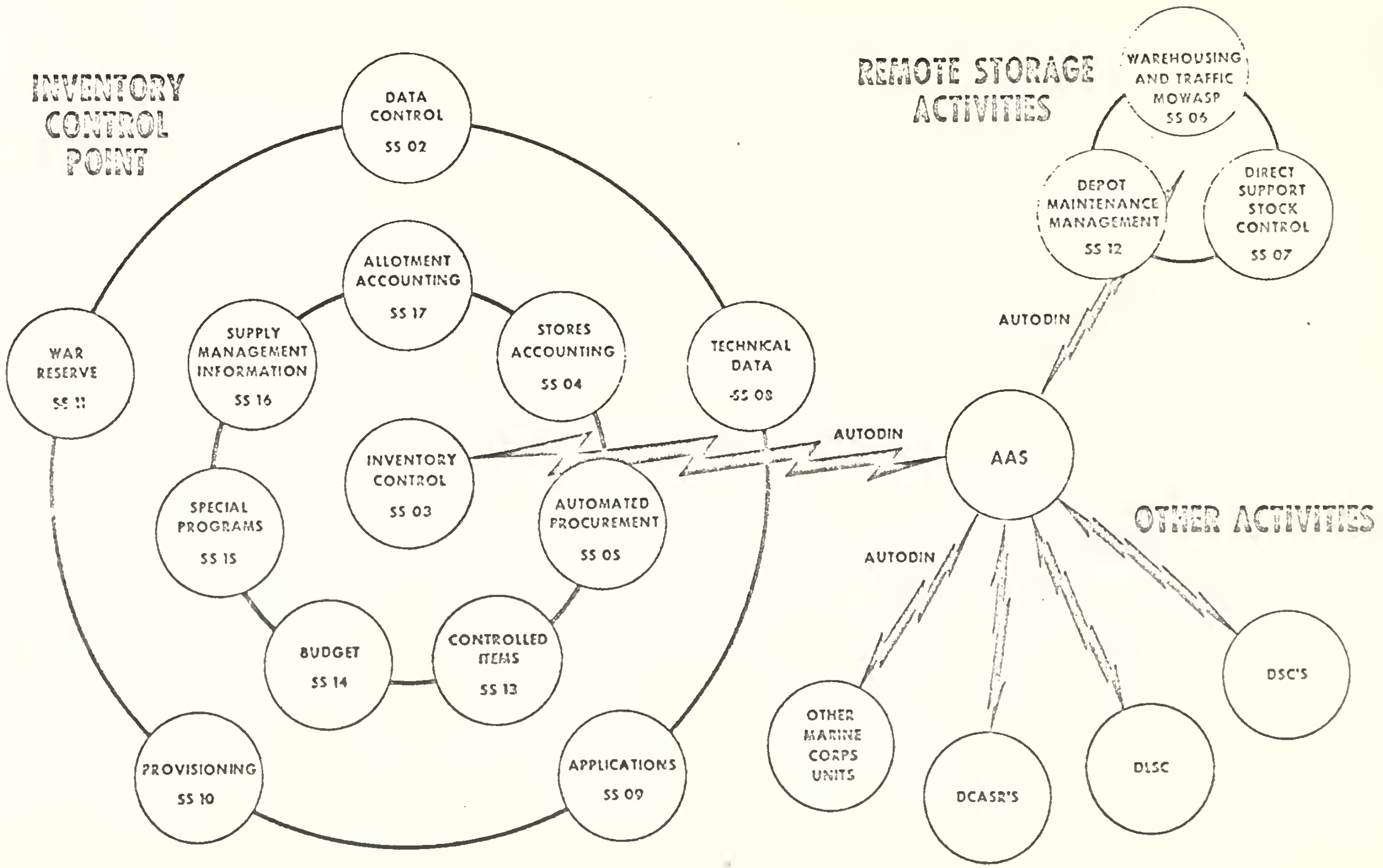
[1] U.S., Department of the Navy, Headquarters, Marine Corps, *MUMMS Introduction Manual*, p. A-01-5.

CHART 1

MUMMS SYSTEM INTERRELATIONSHIPS


INVENTORY CONTROL POINT
DATA CONTROL SS 02
INVENTORY CONTROL SS 03
STORES ACCOUNTING SS 04
AUTOMATED PROCUREMENT SS 05
TECHNICAL DATA SS 08
APPLICATIONS SS 09
PROVISIONING SS 10
WAR RESERVE SS 11
CONTROLLED ITEMS SS 13
BUDGET SS 14
SPECIAL PROGRAMS SS 15
SUPPLY MANAGEMENT INFORMATION SS 16
ALLOTMENT ACCOUNTING SS 17
AUTODIN
AAS
REMOTE STORAGE ACTIVITIES
WAREHOUSING AND TRAFFIC MOWASP SS 06
DIRECT SUPPORT STOCK CONTROL SS 07
DEPOT MAINTENANCE MANAGEMENT SS 12
AUTODIN
OTHER ACTIVITIES
AUTODIN
OTHER MARINE CORPS UNITS
DCASR'S
DLSC
DSC'S

When a customer has a requirement for materiel, he submits a requisition by whatever means he has available, i.e. mail, Naval Message, or AUTODIN. Requisitions are submitted directly to the ICP (see Chart 2, page 58) where they are processed through the computer.

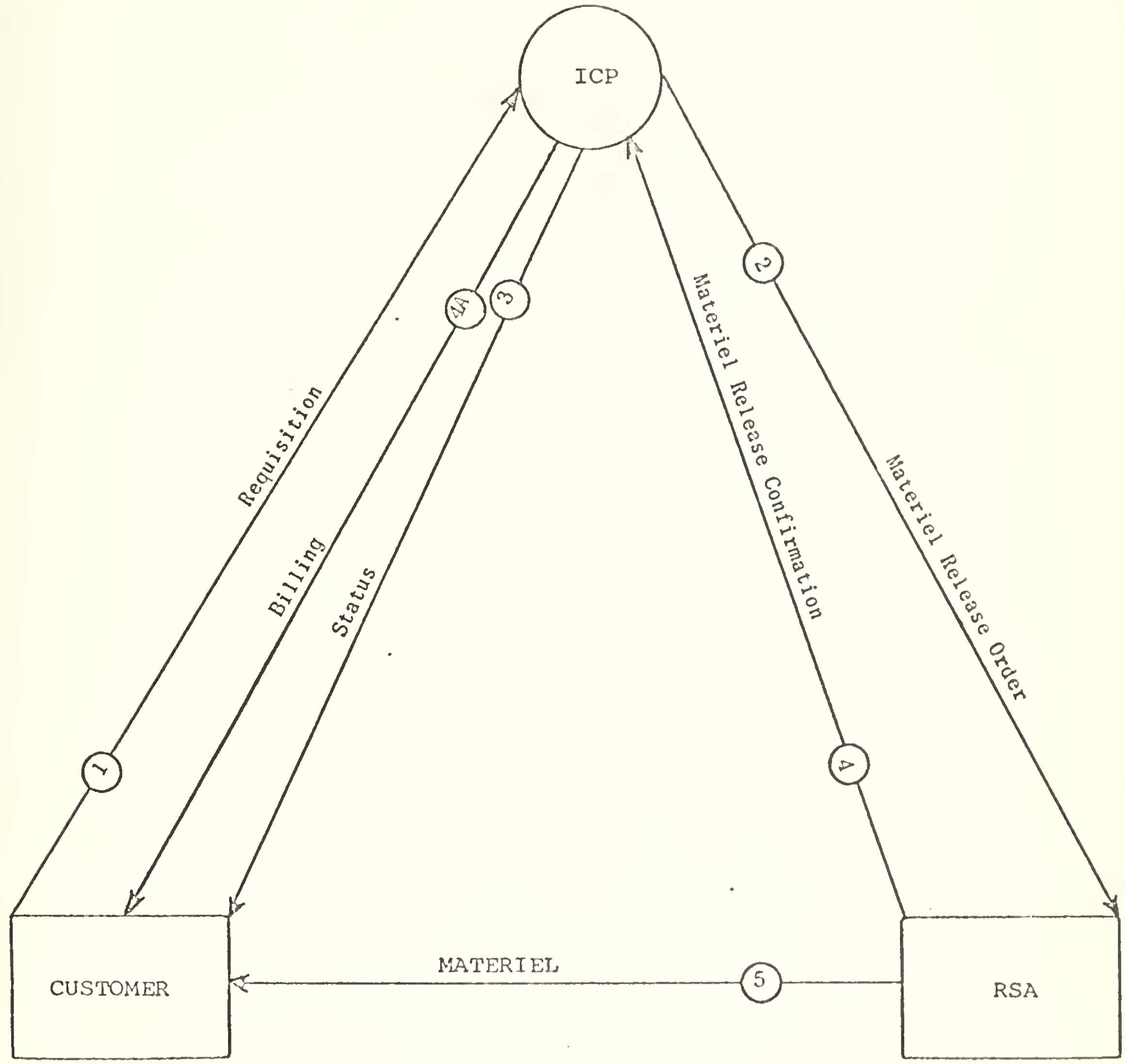
The computer processes the requisitions and screens the assets of the RSAs. When the materiel is located within the system, a Materiel Release Order is sent to the RSA which shows on-hand quantities of the desired materiel and is nearest to the requesting unit. At the same time the MRO is being transmitted, the computer also furnishes status to the customer, informing him of where the materiel will be shipped from and any other pertinent information necessary for his records.

When the MRO is received by the RSA, the item requested is taken from the shelf, packed, and then shipped to the customer. As this process is completed, the ICP is notified by means of a Materiel Release Confirmation (MRC). If the customer has requested an expected delivery date, the ICP can then forward this information.

Should the materiel be unavailable at the RSA after a MRO has been received, the RSA notifies the ICP by means of a Materiel Release Denial. In case of a partial availability, the RSA furnishes the maximum quantity available to the customer. A MRC is sent to the ICP for the amount furnished and an MRD for the amount denied. The ICP then notifies the customer of the exception and rescreens the assets available at the other RSAs until the item is located, or else initiates steps to procure the item if it is not available.

CHART 2

MUMMS
REQUISITION PROCESSING


ICP
① Requisition
② Materiel Release Order
③ Status
④ Materiel Release Confirmation
4A Billing
⑤ MATERIEL
CUSTOMER
RSA

MUMMS also provides for the segmentation of assets on the central computer under three areas:

> D2. Purpose. The current edition of DoD 4140.22M MILSTRIP, provides purpose codes to segment the inventory on the central computer by the purposes for which the materiel is intended; e.g. General Issue, Reserved for Provisioning, Reserved for Loan. These codes are also contained in transactions and other related accounting files. However, materiel is NOT physically segmented in storage by these codes.
>
> D3. Condition. MILSTRAP also provides the ability to segment inventory on the central computer record by the physical condition of materiel. Condition codes are provided for this purpose; e.g. serviceable (issuable without qualification), unserviceable (reparable), suspended (in work). Materiel is physically segmented in storage by these codes.
>
> D5. Location. Assets are segmented on the central computer record by RSAs. The RSAs are located at Albany, Barstow, Camp Lejeune, Camp Pendleton, Parris Island, San Diego, Quantico, and 29 Palms. The MILSTRIP routing identifier code is used to identify the location.[1]

In addition to the above mentioned methods of segmentation, assets can be segmented by ownership and project. Items being stored by the Marine Corps, but owned by other services, are not identified on the ICP Master Inventory File but are maintained by codes contained in the MOWASP item locator files kept by the RSAs. MILSTRIP provides codes for segmenting assets by specific project within the computer and are assigned by the Commandant. Although inventory is not segmented by project within the computer, it can be shown in this manner for report purposes.[2]

The ability to segment assets in these ways has resulted primarily from the utilization of MILSTRIP/MILSTRAP techniques. These two procedures have combined the multitude of programs into a uniform system.

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[1] Ibid., p. A-01-6.

[2] Ibid., p. A-01-6.

MILSTRIP has all of the following advantages: (1) standard requisition format, (2) standard items, (3) multipurpose format for all transactions, (4) standard shipping documentation, (5) uniform supply status data, and (6) standardized supply codes, forms and formats. From the accounting aspect, MILSTRAP has the following features: (1) common system of data elements, codes and card formats, (2) integrated item and financial accounting, (3) standard coding structure, and (4) flexibility-centralized or decentralized.[1]

MUMMS also has provisions for a variety of inquiries and replies. The inquiries possible consist of those from customers, between subsystems, from a subsystem to an item manager or, conversely, from an item manager to a subsystem or even a file within a subsystem. In the case of inquiries concerning files within subsystem, data is distinguished by codes to permit the transmission of only the actual data required. The replies to such inquiries are outputs in the form of punch cards (status to requisitioners), magnetic tape or printed reports.

Computer Processing Concepts

All input/output into the central computer, as well as the RSA computers, is accomplished through AUTODIN, card, tape or remote devices. Input is first edited to determine its completeness and validity and then screened to determine its priority. High priority transactions are processed immediately while those of a less urgent nature are placed on a standby status for processing at a later scheduled time, depending upon the subsystem for which they are being processed. Input is accepted immediately by the computer if it meets the requirements given above.

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[1] "MILSTRIP/MILSTRAP", MUMMS Executive-Supervisory Training, (Philadelphia: Marine Corps Supply Activity, September, 1967), pp. 2-5.

Output through AUTODIN requires a header and trailer record and has a capacity of from 1 to 500 transactions for each transmission. AUTODIN records are prepared automatically by the central processor and output is generated immediately.

The daily processing schedule which is maintained on the IBM 360 computer is shown pictorially on the following page (Chart 3). The bulk of the machine-time available is utilized for the on-line processing of the Inventory Control and Stores Accounting subsystems. Originally, twelve hours were reserved for processing the files for these two subsystems plus an additional four hours which were to be utilized for maintenance processing of the master files for these subsystems. This was modified for reasons discussed later.

During the twelve hour period, input to the two subsystems is processed immediately while other input is queued for cyclic processing during a later scheduled period or as time permits. Other subsystems may be processed during this period if time permits (with the exception of the four hour maintenance period) and the processing of the two scheduled subsystems is not interferred with.

The four hour maintenance processing period updates the master files by reviewing stock levels, posting changes, and reviewing any pending or suspended transactions to determine their status and what follow-up action is required. No input will be processed during this time but the computer will still receive the input, identify it, and queue it for later processing. If priority is high enough to warrant interruption of the maintenance run, the computer will process only those details necessary to furnish status to the requisitioner and queue the remainder for later action.[1]

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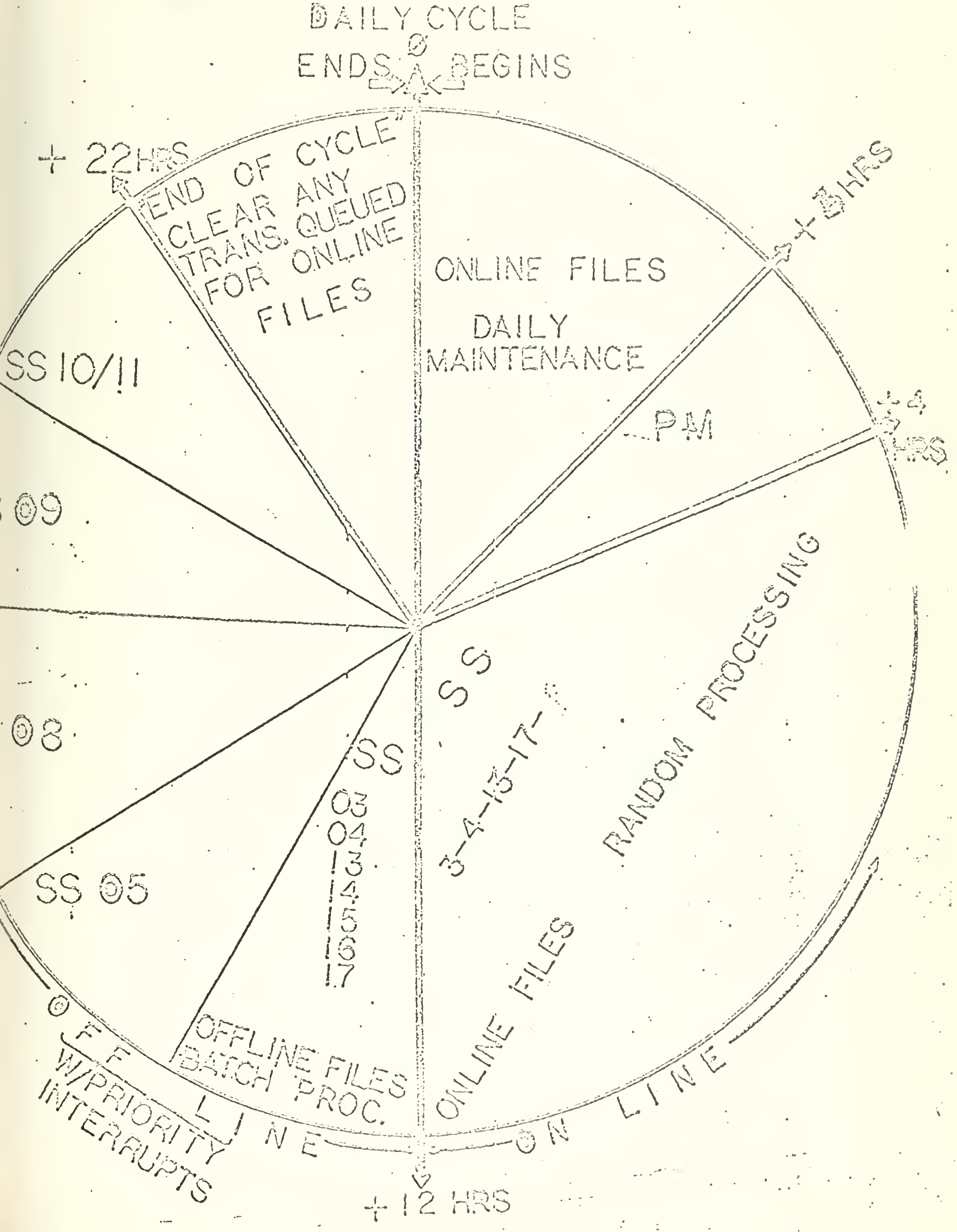
[1] U.S., Department of Navy, Headquarters, Marine Corps, p. A-02-3.

Chart 3

COMPUTER PROCESSING: DAILY CYCLE


DAILY CYCLE
0
ENDS BEGINS
+ 22 HRS
"END OF CYCLE"
CLEAR ANY TRANS. QUEUED FOR ONLINE FILES
ONLINE FILES
DAILY MAINTENANCE
+ 3 HRS
PM
+ 4 HRS
SS 10/11
09
08
SS 05
SS 03 04 13 14 15 16 17
SS 3-4-13-17-
RANDOM PROCESSING
ONLINE FILES
OFFLINE FILES BATCH PROC.
ONLINE FILES
0 F F L I N E
W/PRIORITY INTERRUPTS
0 N L I N E
+ 12 HRS

Seven hours of machine time were reserved for cyclic processing of all other subsystems and one hour was scheduled for preventative maintenance. The actual workload which is depicted by Chart 1, varies slightly from the preconceived workload which was described above. It was found that the system could not handle the inventory/stores subsystems in the time allotted so commercial processing time was partially utilized.

The time allotted these two subsystems was, in fact, reduced to permit complete processing of the remaining subsystems. This allowed them to limit their commercial use to the two subsystems and eliminate some of the complications which might arise from using a great many subsystems.

Command Relationships

As mentioned previously, the RSAs are under the control of the commander of the base at which they are located with the exception of technical matters pertaining to the supply system. Technical matters fall under the cognizance of the ICP. These technical matters extend to such areas as: (1) Work measurement at RSAs; (2) System effectiveness; (3) Marine Corps Supply System-wide Reports and Reporting Systems; (4) Computer processing; (5) Operational (supply) procedures; (6) Centrally manager materiel; (7) Receipts control function; (8) Space utilization at RSAs; (9) Physical inventories; and (10) Financial management of stores account.[1]

In addition to these areas, the ICP also advises the Commandant of the Marine Corps on establishing RSA missions and functions, tables of organization and funding. The ICP also is responsible for providing actual technical assistance as requested as well as preparing system directives and technical guides.

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[1] *Ibid.*, pp. A-04-3 to A-04-6.

The RSA has the responsibility for direct supply support for base operations. Although the ICP establishes stock levels for this operation, the RSA determines its requirements, procures and requisitions decontrolled items as required, performs items to the Commandant of the Marine Corps.[1]

As mentioned previously, some time would be devoted to a discussion of the subsystems. The nature of MUMMS is such that each subsystem is essential for overall system effectiveness. The total integration and interfaces of the subsystems permits the analogy that a "chain is only as strong as its weakest link." With this in mind, let us look at different subsystems, concentrating primarily on their concepts and key features.

MUMMS SUBSYSTEMS

SUBSYSTEM 02: DATA CONTROL

Data processing support for MUMMS is supplied by the IBM 360 computer. To link the thousands of individual programs to the hardware, MUMMS utilizes a software program known as the Operating System/360 (OS/360). Software has advanced through two other stages in arriving at the ultimate system. The first two, the Basic Operating System (BOS) and the Disc Operating System (DOS), were not able to cope with the unforseen complexities which plagued the first few months of operation.

To direct the data processing effort, an Office of Data Processing was established. This office consisted of a director, a Program and Procedures Branch, a Processing Branch, and an Operations Office composed of 12 data systems analysts.

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[1] Ibid., p. A-04-5.

The Data Control system provides MUMMS with a number of capabilities. Among these capabilities are real time processing, direct communication to RSAs, direct access storage, multiprogramming, source data automation, inquiry capability, immediate and deferred inquiry response, and batch processing.[1]

The chart on the following page shows the types of processing cycles which the system employs. The sequential processing cycle is utilized for transactions of a less urgent nature while the higher priority ones are processed by direct access.

Sequential processing is a method for updating a file where each record on the file is examined in some pre-determined sequence. The transactions which are used to update the master file are in the same sequence, and when the identifying number on the transaction and the master file record are found to match, that record will be updated.

To make this method feasible and economical, sequential processing employs a technique known as batch processing. This technique accumulates a great deal of input before it is processed against the master file. It does, however, limit the number of master files which can be used at one time and necessitates successive runs to update each file in a system.

The sequential processing method does not have a need to call up information immediately, and, therefore, it utilizes non-addressable bulk storage rather than direct access storage used in the direct access processing. This type of storage consists of cards, paper tape or magnetic tape and gives the capability of holding large amounts of data at a low cost. The computer

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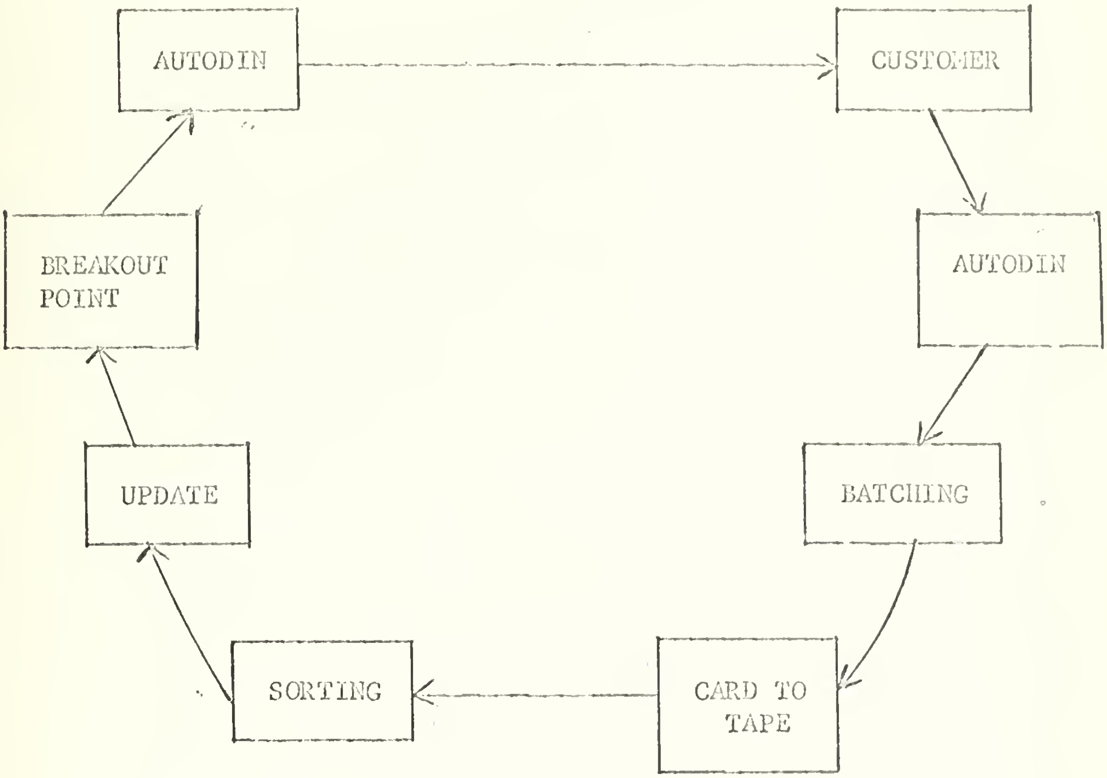
[1] "Data Processing Support for MUMMS", MUMMS Executive-Supervisory Training, Chart 3.

cannot go directly to a piece of information desired but must examine all of the data in sequence until the correct information is located.

CHART 4

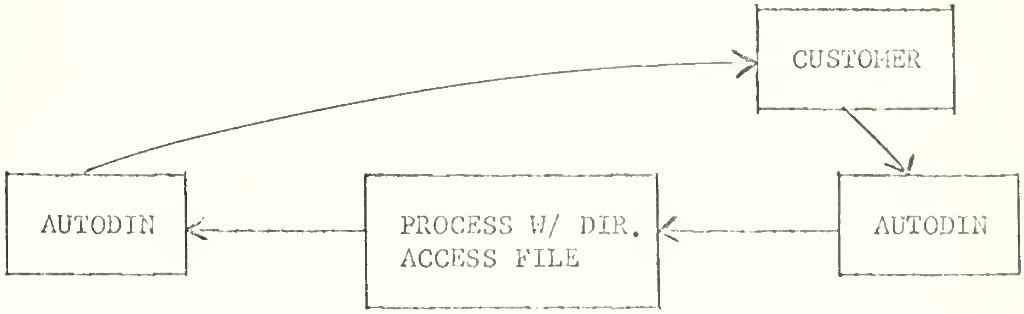
SEQUENTIAL PROCESSING CYCLE

(Hours)


AUTODIN
CUSTOMER
AUTODIN
BATCHING
CARD TO TAPE
SORTING
UPDATE
BREAKOUT POINT

DIRECT ACCESS PROCESSING CYCLE

(Seconds)


CUSTOMER
AUTODIN
PROCESS W/ DIR. ACCESS FILE
AUTODIN

Source: MUMMS EXECUTIVE-SUPERVISORY TRAINING, September 1967

This type of processing, although economical, operates in a time-frame described in hours. There are many cases, however, where priority dictates that data be processed in a matter of seconds. For this reason, MUMMS also has the capability for direct access processing.

Direct access processing allows the computer to go directly to the information desired without going through the whole file. To permit this, a storage device known as addressable bulk storage is employed.

The advantages of direct access storage are readily apparent. First, there is a direct referencing of data while processing and sequential processing is reduced. There is also less manual intervention and immediate inquiry response capability. The latter advantage is not presently available to the manager because requisition processing is taking precedence.[1]

In addition to these advantages, direct access processing also leads to more effective programming. The required programs are more difficult to write but fewer are required. It keeps several files updated without output from one transaction having to be programmed to update another file.

Closely related to the capability of direct access storage is that of real time processing. Real time is the characteristic of a system in which there is so little control of input/output rates that the entire design of the system is dominated by the need to ensure that the system can receive and transmit data commensurate with these rates. It also has the characteristic of updating a record immediately following any change to data in the record.[2]

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[1] Ibid., Chart 6.

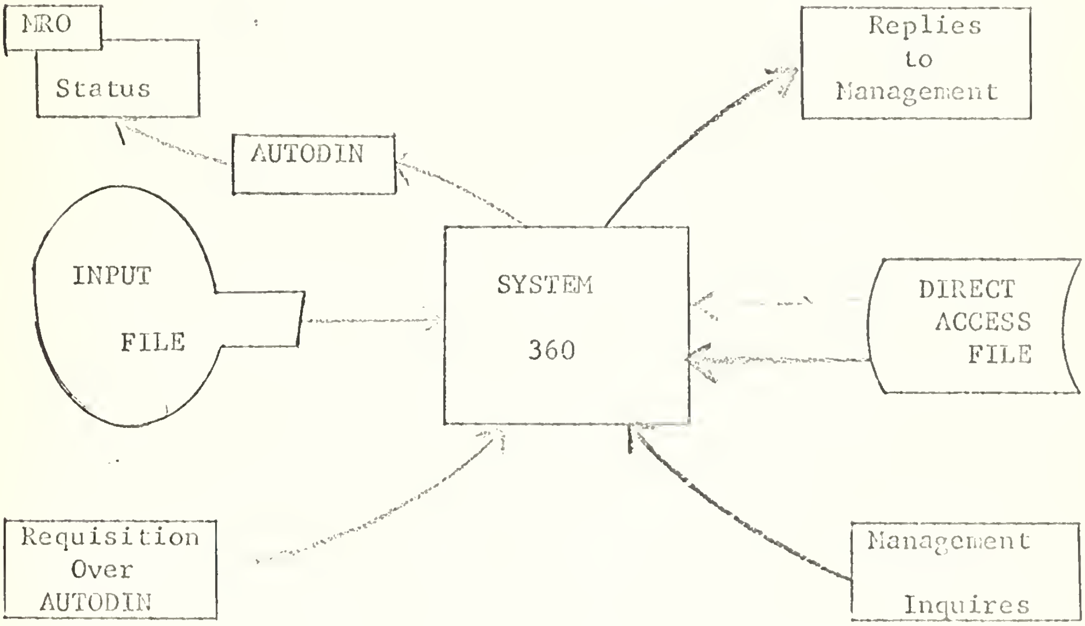
[2] Ibid., p. 2.

At present, there are five subsystems capable of being updated in real time: Inventory Control, Stores Accounting, Mechanization of Warehousing and Shipment Processing, Controlled Item Management, and Automated Allotment Accounting. The remainder of the subsystems, with the exception of the War Reserve subsystem, have direct access files, but presently batch processed. There is at present no intention of having a requirement for immediate updating of these subsystems. The War Reserve subsystem is maintained on tape and is only capable of being processed by sequencing.

Data Control also gives the capability for multiprogramming. Multiprogramming allows the execution of a number of programs in such a way that none of the programs need be completed before another is started or continued. The chart below depicts this capability.

CHART 5

MULTIPROGRAMMING


MRO
Status
AUTODIN
Replies to Management
INPUT FILE
SYSTEM 360
DIRECT ACCESS FILE
Requisition Over AUTODIN
Management Inquires

Source: MUMMS Executive-Supervisory Training, September 1967.

The background program, depicted on the preceding chart by the blue lines, is the main process being run by the computer, such as updating the Inventory Control files. A foreground program, shown by a red line, is a program, such as an inquiry, which is designed to interrupt the program being processed.

There are two devices for interrupting; a 1050 device and a cathode ray tube device which interrupts the program immediately. Under full operation, the system will be able to operate two programs simultaneously. All of these capabilities provide MUMMS with certain inherent advantages. It provides flexibility for increased supply requirements; compatibility, precluding any future equipment changes; programming more responsive to system changes; a central data bank of management information; and immediate response to inquiry.[1]

Subsystem 04: Stores Accounting

> The Stores Accounting Subsystem is designed as an automated operation to record and accumulate all data required for financial analysis of inventory movement and to control and account for cash resources as well as financial inventory balances. From the input data, current and timely management and financial reports are produced for review and decision making and for financial control actions under the budget process. This subsystem receives transactions which affect the Marine Corps Stock Fund and the Marine Corps Appropriation Stores Account master inventory and direct support stock control records, computes the dollar value of transactions, and simultaneously updates both the stores balance records and the Marine Corps Stock Fund's general ledger accounts.[2]

This subsystem maintains nine files for processing. The two main files, Stores Summary and Financial Summary, are maintained and updated

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[1] *Ibid.*, Chart 7.

[2] U.S., Department of the Navy, Headquarters, Marine Corps, *MUMMS Introduction Manual*, p. B-02-3.

simultaneously on-line with the inventory file. The remaining files are maintained off-line and are updated during the file maintenance period. These files are: Billing Receipts Reconcillation, Cost Analysis, General Ledger Master file, Stores Master file, Transaction History and Suspense file.

Automation plays an important part in this subsystem. In addition to providing accurate and current fiscal data, this subsystem has automated management of data by exception, automated billing, automated reconcillations for both accounts payable and accounts receivable, as well as automated techniques for establishing standard unit prices.

Stores Accounting also permits daily, as well as monthly, billing management, financial and budget reports on a weekly, monthly, and quarterly basis. All of these reports are produced from data contained in the subsystem files.

Subsystem 05 - Automated Procurement

> The Automated Procurement Subsystem (APS) provides semiautomated request for quotation/order (RFQ) for supplies or services for commercial purchases generated by the Inventory Control Subsystem. In addition to the RFQ for supplies or services document, a tear-off trailer is also printed out. The trailer contains previous procurement history for the item; identification of potential suppliers; specification and drawing numbers, when applicable, and other pertinent data necessary for the buyer to select, solicit bids, evaluate, and award.[1]

To store the required information four files are utilized: (1) Procurement History-FSN sequence (Disk); (2) Purchase Identification-FSN sequence (Data cell); (3) Manufacturer/Dealer Address (Disk); and (4) Contract Administration (Tape). From these files the following is

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[1] *Ibid.*, p. B-03-3.

supplied to each buyer:

a. Supply Sources - 10 locally coded, 10 Federally coded

b. Names & Addresses of 10 of the above sources

c. 5 Previous Procurements to facilitate quote evaluation

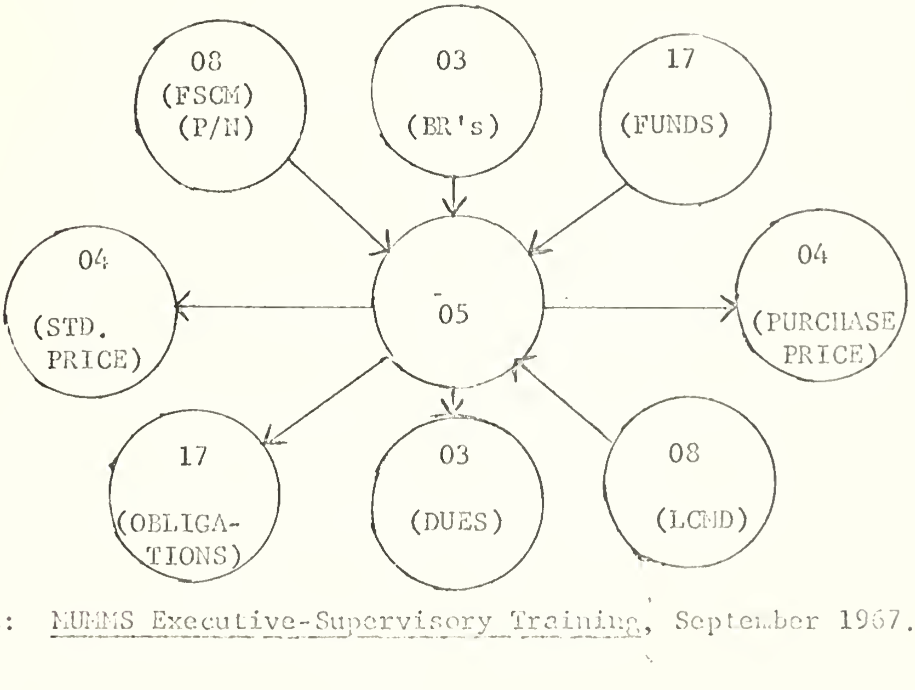
d. Partially Complete procurement history card

These steps help to effectively reduce the administrative lead time in the procurement process. The subsystem conversely has the ability to stop procurement action automatically if any essential data are missing. In addition, this subsystem also incorporates the ability to combine items for solicitation so it is possible to procure them from the same segment of industry.

This subsystem also receives and generates information for four other subsystems within MUMMS: Inventory Control (03), Stores Accounting (04), Allotment Accounting (17), and Technical Data Management (13). These relationships are shown on the chart below.

CHART 6

AUTOMATED PROCUREMENT SUBSYSTEM RELATIONSHIPS



Source: MUMMS Executive-Supervisory Training, September 1967.

From the Inventory Control subsystem, APS receives computer buy recommendations (BR), follow-ups, and cancellation requests. APS in turn generates output to Inventory Control in the form of due-in transactions, replies to follow-ups, revised delivery dates, and shipment notices.

Two of the four subsystems, Stores Accounting and Allotment Accounting, do not supply APS with any input. Stores Accounting, however, receives financial transactions for pricing and shipment notices from APS, while Allotment Accounting receives obligation and decommitment transactions.

The final subsystem interfacing with APS, Technical Data Management, receives no output but does provide essential input. This input consists of Federal Supply Code of Manufactures, part numbers, and Local Codes for Dealers and Manufacturers.

To better understand the processing which takes place in this subsystem, a flow chart is shown below which traces a buy recommendation from Inventory Control. The codes shown which are of prime concern are 910 (Procurement Services Branch), 900 (MUMMS Control Unit), and codes 912-915 which represent the actual buyers.

CHART 7

PROCESSING IN AUTOMATED PROCUREMENT SUBSYSTEM

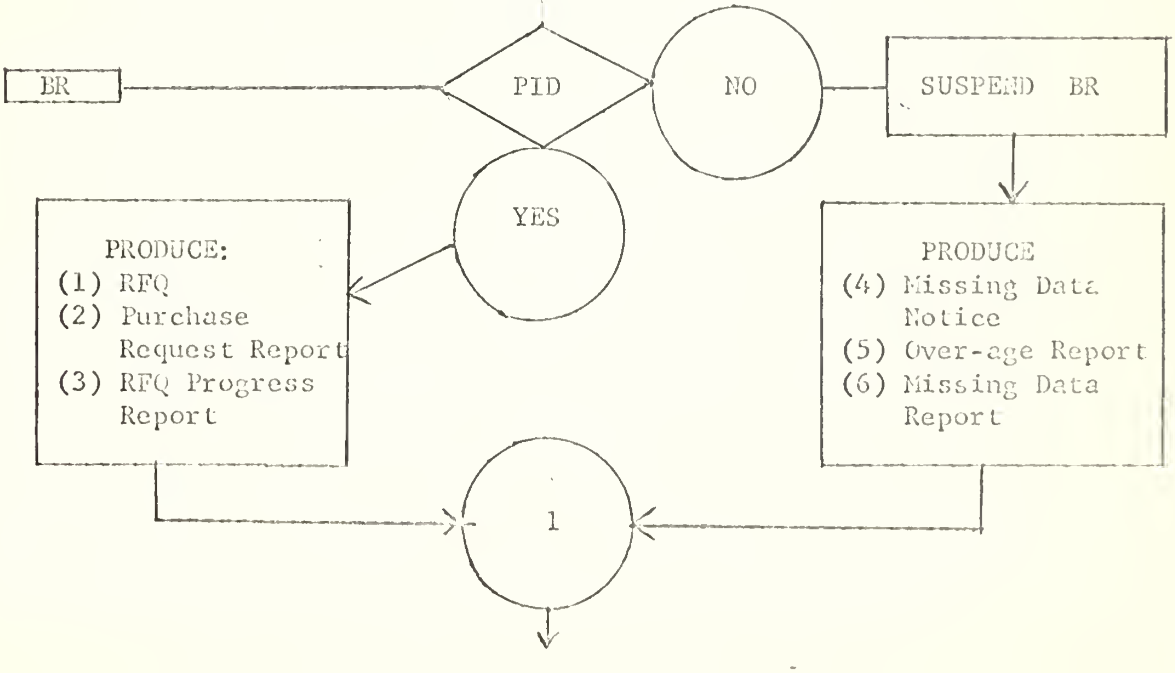
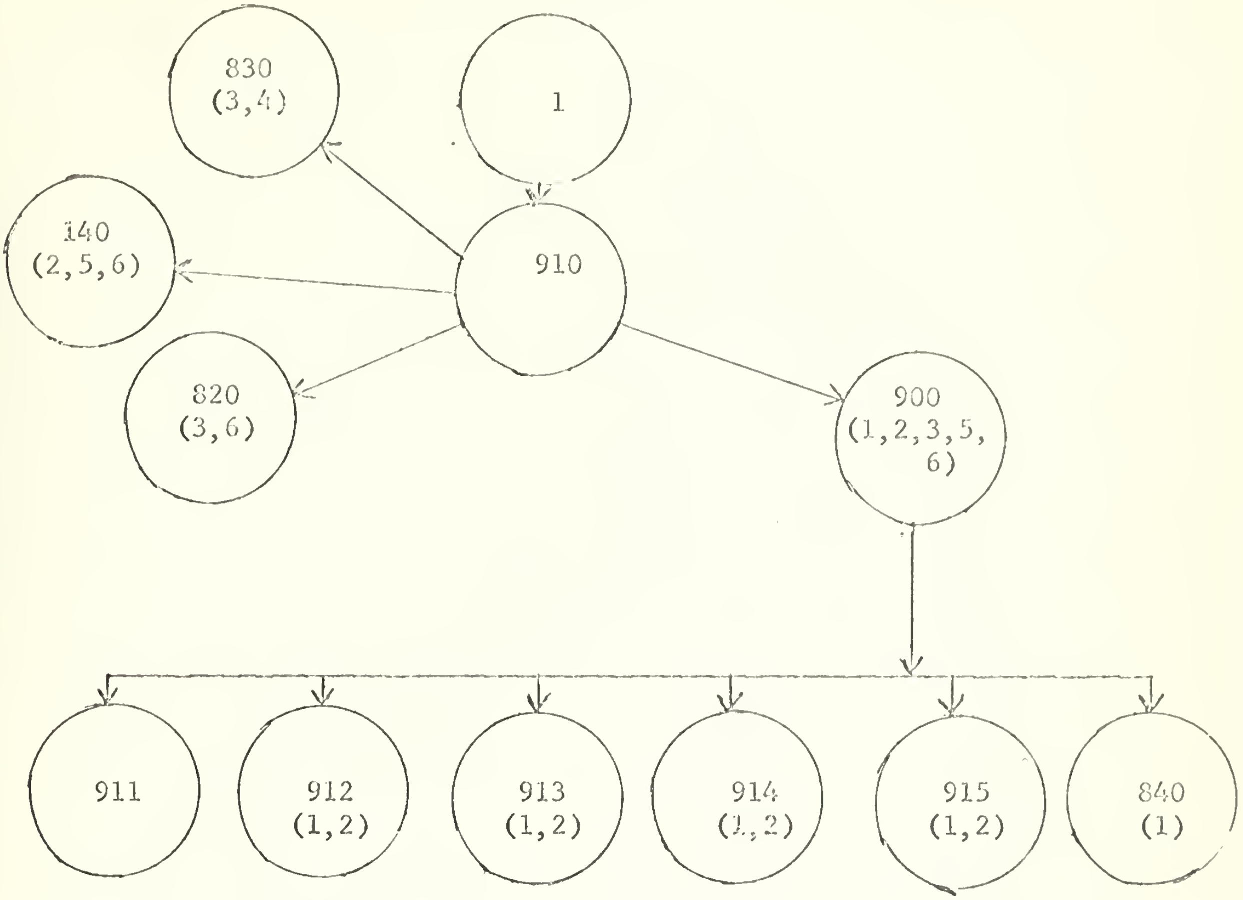

BR
PID
NO
SUSPEND BR
YES
PRODUCE:
(1) RFQ
(2) Purchase Request Report
(3) RFQ Progress Report
PRODUCE
(4) Missing Data Notice
(5) Over-age Report
(6) Missing Data Report
1

CHART 7 (cont)



Source: MUMMS Executive-Supervisory Training, September 1967.

Subsystem 06 - Mechanization of Warehousing and Shipment Processing (MOWASP)

> The MOWASP Subsystem is an automated procedure for shipment of supplies, receipts, in-storage operations, and preparation of management reports. This subsystem is required due to the adoption of the MILSTRIP and MILSTAMP automated procedures. It covers the following functions: the receiving process; the issue/shipment process; the preservation and packing process; operational inspection of technical items; and space reporting.[1]

In the performance of the functions noted above, both the ICP and the RSA have certain responsibilities. To highlight these responsibilities, the following table lists the procedures for processing receipt transactions.

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[1] Ibid., p. B-04-3.

TABLE 10

RESPONSIBILITIES FOR RECEIPT TRANSACTIONS

ICP	RSA
1. Provide RSA with notice of materiel to be received	1. Receipt & visual inspection & preparation of documentation (T)
2. Provide RSA with copies of contracts for inspection/acceptance of materiel	2. Manual suspense file of advanced copies of bills of lading (T)
3. Disposition instructions for receipts discrepancies reported by RSA	3. Maintain file of contracts for inspection/acceptance of materiel (R)
4. Determine RSA stock levels for all FSNs	4. Receipt of materiel (R)
	5. Inspection & identification of materiel (R)
	6. Obtain storage locations (R)
	7. Researching & building data for PMR file when not available (R)
	8. Placing materiel on location (S)
	9. Confirmation of placement (S)

Note: T - Transportation element; R - Receipt element; S - Storage element

Source: MUMMS Executive-Supervisory Training, September 1967.

All the data essential for this subsystem are maintained on file by the computers at each RSA. These files contain information on receipts, work-in-process and shipment data, and also technical data pertaining to the Care-in-Store and Freight/Transportation functions. The two larger RSAs at Albany and Barstow maintain additional files due to their repair functions.The additional files contain information necessary to process major items through the repair facility and, at the same time, record

actual repair progress data. The larger computer capabilities of these two locations is essential because of the high degree of detail (e.g. Government Bills of Lading require not only standard freight information but the tariffs of various carriers must also be considered).

The advantages of this subsystem can be seen by a description of its basic operation. Consider, for example, the capabilities inherent in the subsystem upon the receipt of a Materiel Release Order (MRO) from the ICP. Depending upon the priority, the computer either accumulates the MRO's (Priority 9-20) for processing on a controlled basis or processes them immediately if required.(Priority 1-8).

Having received the MRO's, the computer can automatically produce the following reports: (1) daily workload forecasts of MROs available for release; (2) MROs requiring management decisions before being released for shipment; (3) summary listings of workload by warehouse; and (4) control listings for shipment planning.[1] In addition to the reporting functions, MOWASP has the capability to automatically:

(1) Compute storage space requirements and assign locations;

(2) Produce bin replinishment notices;

(3) Schedule surveillance inspections;

(4) Check validity of location data periodically;

(5) Select samples for inventory; and

(6) Collect data for costs, performance, budget, space, and manpower external reports.[2]

In addition to the automated capabilities afforded by the high speed computer configurations at the RSAs, the added facility of remote input/

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[1] U.S., Department of the Navy, Headquarters, Marine Corps, System Specifications for MUMMS, p. 06-2

[2] *Ibid.*, p. 06-2 to 06-3.

output devices provides rapid inquiry and response from and to key operational areas. The advantages of these devices can be seen by the utilization of feedback information for preparing bills of lading, transit time reporting, Materiel Release Confirmation to clear records suspense file, and control and measuring of internal processing.

The procedures utilized throughout MOWASP hinge on the principle of management by exception. This enables operations and procedural methods to be simplified with the thought of eliminating, as much as possible, unnecessary manual methods.

Subsystem 07 - Direct Support Stock Control (DSSC)

> The DSSC Subsystem is designed to record and accumulate all data required for routine record keeping, requisitioning, reporting to the Inventory Control and S Stores Accounting Subsystems, and maintaining history. The accounts within the subsystem are: self-service centers, shop stores, retail clothing outlets, subsistence accounts, ammunition accounts, POL, and separate individual clothing accounts. All materiel in the subsystem belongs to the distribution system.[1]

The ICP accounts for materiel within the subsystem by dollar value only. All other stock management functions such as computation of requirements and item accounting are performed locally. There are no requisite requirements for submitting requisitions and customers need only comply with locally established procedures. Stock at issue points is replenished by submitting requisitions to the ICP or through local procurement where allowed.

All stock records for these accounts are maintained by the RSAs. Daily item/value reports of transactions are forwarded to the ICP and

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[1] U.S., Department of the Navy, Headquarters, Marine Corps, MUMMS Introduction Manual, p. B-05-3.

Quarterly Asset Status Reports are prepared for reconciliation with ICP records. The account can be one of three types - manual, punched card, or computer loaded - and is determined by the location, items stocked, and the daily transaction volume.

Primarily, DSSC serves to eliminate record keeping at the issue point level and introduces automation where the volume dictates. The chart on the following page gives an overview of this subsystem, highlighting the interfaces between it and the other subsystems.

Subsystem 08 - Technical Data Management

> Technical Data Management Subsystem is designed to establish the policies and rules and to develop the procedures related to the Federal Cataloging Program and selected management data programs of DoD, DSA, and the Marine Corps. These policies, rules, and procedures provide instructions and guidance for the development, maintenance, notification, and publication of Federal Catalogs, technical and selected management data. The detailed procedures of this subsystem outline specific functions and responsibilities necessary to maintain pertinent files of data related to items of supply and production and provide a means of ready retrieval of stored data through the use of inquiry techniques; provide notification of cataloging and management data changes to Marine Corps organizations and certain DoD activities; interface with, and provide information to other materiel management systems and be compatible with DoD/DSA materiel management systems; furnish cataloging and management data support for specific functions and operations of ICP programs, as required.[1]

The six major files contained within this subsystem are: Items, Reference Number, Suspense, Change, History, and Edited Description File. Of these files, the Item file is of primary importance, not only in size but also in content. This file is in Federal Stock Number (FSN) sequence

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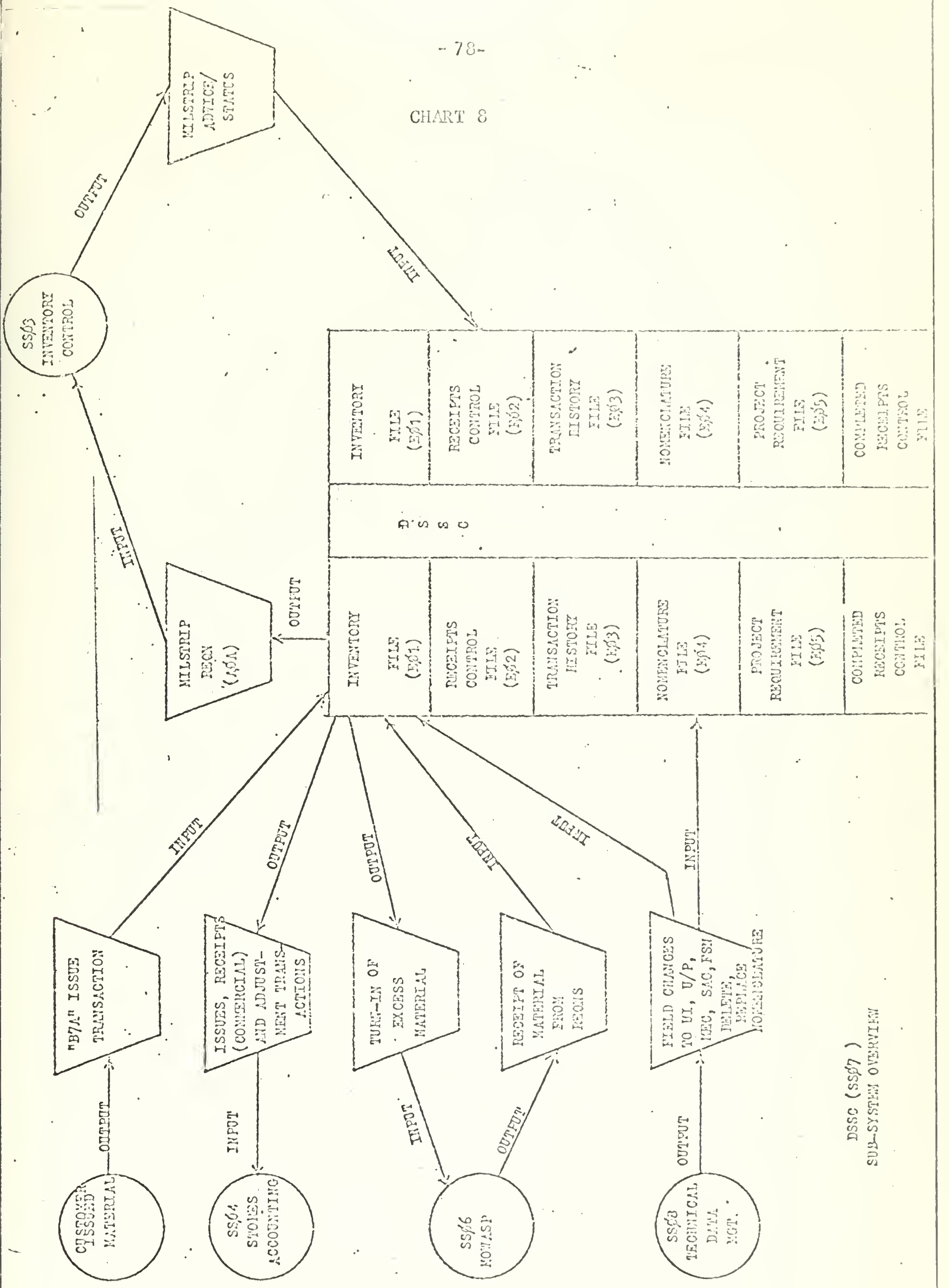
[1] *Ibid.*, p. B-06-3.

CHART 8


SSφ3 INVENTORY CONTROL
OUTPUT
MILSTRIP ADVICE/ STATUS
INPUT
INPUT
MILSTRIP REQN (AφA)
OUTPUT
INVENTORY FILE (Eφ1)
RECEIPTS CONTROL FILE (Eφ2)
TRANSACTION HISTORY FILE (Eφ3)
NOMENCLATURE FILE (Eφ4)
PROJECT REQUIREMENT FILE (Eφ5)
COMPLETED RECEIPTS CONTROL FILE
D S S C
INVENTORY FILE (Eφ1)
RECEIPTS CONTROL FILE (Eφ2)
TRANSACTION HISTORY FILE (Eφ3)
NOMENCLATURE FILE (Eφ4)
PROJECT REQUIREMENT FILE (Eφ5)
COMPLETED RECEIPTS CONTROL FILE
INPUT
OUTPUT
OUTPUT
INPUT
INPUT
INPUT
"B7A" ISSUE TRANSACTION
ISSUES, RECEIPTS (COMMERCIAL) AND ADJUSTMENT TRANSACTIONS
TURN-IN OF EXCESS MATERIAL
RECEIPT OF MATERIAL FROM REOMS
FIELD CHANGES TO UI, U/P, MEC, SAC, FSN DELETE, REPLACE NOMENCLATURE
OUTPUT
INPUT
INPUT
OUTPUT
OUTPUT
CUSTOMER ISSUED MATERIAL
SSφ4 STORES ACCOUNTING
SSφ6 NOMASP
SSφ8 TECHNICAL DATA MGT.

DSSC (SSφ7)
SUB-SYSTEM OVERVIEW

Source: MUMMS Executive- Supervisory Training, September, 1967.

and includes the header, management data, user, reference number, standardization, cancellation, and index records.

Responsibility for this subsystem is vested solely at the ICP level. This subsystem enables the ICP to carry out its cataloging functions in relation to DSA programs concerned with Supply Support Requests and Item Management Coding. In addition to these, it also provides for publishing Marine Corps Federal Catalog Management Lists and identifies FSNs to technical documentation.

Allied to this subsystem was the conversion from Supply Management Codes to the standard DoD Phrase Codes. These codes, although standardized, still serve the same purpose - to show specific management decisions, such as cross-reference between outmoded and current stock numbers, procurement, interchangeability, disassembly, and disposition instructions.

An additional feature of this subsystem is the Interchangeability and Substitution Grouping Program (I&S). The objectives of the I&S Program are twofold. First, to identify the possibility of certain items possessing features which enable them to be interchanged or substituted for another item. Secondly, to use these relationships to satisfy needs out of current assets.

To achieve these objectives four steps were developed. The first step was to segregate items into related families. Next, the families were divided into groups of interchangeable items. Following this, an Order of Use Code was developed which would automatically ship a suitable substitute if the item requested was not available. Finally, provisions were made to update the data in a current status by adding new items and deleting items which have become obsolete.

Subsystem 09 - Applications

> The Applications Subsystem provides an automated capability to maintain certain elements of current management data for all stock numbered items in the Marine Corps Materiel Support System. It computes retention levels for special item categories to ensure protection of assets. Peculiar and common parts of equipment are identified, as well as items which are to be phased out of the system. It is also the source for the Marine Corps Stock List SL-6, and it provides data for the maintenance of other stock lists.[1]

It is essentially a centralized means of identifying end items, major components, and depot reparables used by the Marine Corps and the repair parts needed to support these items. More specifically, the Applications Subsystem has eight main features[2]:

(1) Identify items with ID numbers and determine their interrelationships;

(2) Identify a repair part with all of its applications;

(3) Determine the range and density of spare parts needed to support an end item;

(4) Identify items scheduled for phaseout, replacement, or disposal;

(5) Assign items for special retention levels to protect assets;

(6) Identify items common or peculiar to the system;

(7) Develop data for inventory management; and

(8) Provide data for SL-6 publication.

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[1] Ibid., p. B-07-3.

[2] "Applications SS09", MUMMS Executive-Supervisory Training, September 1967, p.2.

Subsystem 10 - Provisioning

> The Provisioning Subsystem assures that initial spares, repair parts, special tools, test equipment, and support equipment required for initial support of new items are procured and protected from general issue and are distributed on a timely basis to appropriate organizations. This subsystem, through other subsystems, causes single managers supply support (DSA/GSA) to be established; updates/establishes applications files; prepares repair parts orders (RPO); causes new items to be entered into the Inventory Control Subsystem; prepares Marine Corps Stocl List SL-3 and SL-4; provides financial management data necessary for budgetary purposes; and evaluates the effectiveness of provisioning.[1]

This subsystem consists of three major files which contain information on end items, using and supporting unit data, and repair parts. Also included are provisioning performance schedules developed at the preprovisioning conference, as well as completion dates on which to base provisioning actions.

The end item information file (H01) extracts information from three sources; procurement document and provisioning guidance from the Commandant of the Marine Corps, and the provisioning conference. File H02, organizational information, receives its input through provisioning guidance from the Commandant, Marine Corps Order P4400.79, Provisioning Order, and the applicable Tables of Organization. The final file, repair part information (H03), extracts information from both the ICP Equipment Specialist and the Provisioning Documentation Package.

In support of this subsystem, the ICP has five responsibilities. These responsibilities are[2]:

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[1] U.S., Department of the Navy, Headquarters, Marine Corps, MUMMS Introduction Manual, p. B-08-3.

[2] U.S., Department of the Navy, Headquarters, Marine Corps, Systems Specifications for MUMMS, p.10-2.

(1) Prepare Provisioning Load Card for entry into the the Inventory Control Subsystem;

(2) Prepare Provisioning Initial Issue Cards;

(3) Maintain Provisioning Initial Issue File;

(4) Prepare Management Reports; and

(5) Issue materiel to using units or transfer to proper purpose code on the initial issue date.

Provisioning effectiveness is determined through a comparison of the provisioning requirements and the in-service usage data supplied by the using units. This is 'after-the-fact' information, but it does generate data for future budgetary purposes and helps evaluate the data which are being used to compute provisioning requirements.

Subsystem 11 - War Reserve

> This subsystem develops the record of all M-Day materiel requirements authorized for acquisition in the Marine Corps. Requirements established by the various withdrawal plans are processed routinely in the Inventory Control Subsystem to ensure protection of assets attained. The records developed by this subsystem provide the necessary transactions to the stratification process. Upon execution of a withdrawal plan. this subsystem generates the necessary transactions to the Inventory Control Subsystem to cause the release of the required materiel. The overall concept is tailored to provide immediate response to the FMF materiel support requirements at M-Day or any 'short-of-war' situation.[1]

The War Reserve Subsystem entails a central control unit within the ICP to administer Fleet Marine Force requirements for Cloud, Storm, and Hail. The administration includes the registration, attainment, and protection of mobilization requirements as well as providing for the release of War Reserve materiel when deemed necessary by the FMF commanders.

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[1] U.S., Department of the Navy, Headquarters, Marine Corps, MUMMS Introduction Manual, p. B-09-3.

Semi-annually, this subsystem also provides reports to the units concerned, reflecting requirements, degree of attainment, and deficiencies.

To perform these functions there are six files maintained within this subsystem: Master Equipment Deck, Replacement Factor, Equipment Density, Withdrawal Plan, Projects Requirements, and Master Inventory. The various relations existing between War Reserve and the other subsystems are given in the table below.

TABLE 11

WAR RESERVE SUBSYSTEM RELATIONS

ACTION	FROM	TO
Attained Requirements	03	11
Phrase Code Actions	08	11
Unit of Issue with Factor	08	11
Unit of Issue without Factor	08	11
Unit Price Changes	08	11
MEC and SAC Changes	08	11
Provisioned Factors/Densities/Date	10	11
Registration of War Reserve Requirements	11	03
Release Transactions for Withdrawal	11	03
PWR Requirements for Stratification	11	14

Source: "War Reserve Subsystem," _MUMMS Executive-Supervisory Training_, September 1967.

Subsystem 12 - Depot Maintenance Management

> The Maintenance Management Information System has been designed to provide for management control and cost reduction within Depot Maintenance Activities. In formulating the design of this system, consideration was given to the future application of these management procedures to all organizational elements at major installations within the Marine Corps.[1]

The system relies on remote devices located at strategic areas

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[1] "Depot Maintenance Management," _MUMMS Executive-Supervisory Training_, September 1967, p.1.

throughout the production area. Input is generated at the source through employee utilization. Employees are assigned badge cards and pre-punched job cards describing some aspect of the operation. Not only does this capture data at the source, but it also provides for system responsiveness by reporting an action when it occurs.

All input is processed immediately by the computer, transactions are analyzed, and management is informed of all exceptions. The analysis is performed by selection and comparison of appropriate files which are simultaneously updated. If there are no exceptions, the computer determines if the data are needed for any reporting purposes or are primarily historical data.

As historical data are accumulated, they are utilized in formulating future plans for production. The history files contain data in such areas as usage of time, manpower, materiel, money, or any other pertinent information.

All of this input and computer analysis produces certain measures. Among these are labor utilization (i.e. attendance/absence, earned time vs. standard time, etc.), cost analysis reports, quality assurance, materiel requirements and usage, and historical data.[1]

The key feature, which was alluded to previously, is the ability to provide exception data through computer analysis. By disclosing intolerable variations in production to the appropriate managerial level, corrective action can be initiated immediately. Moreover, management can now base its critical production decisions on current information and not past history.

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[1] U.S., Department of the Navy, Headquarters, Marine Corps, MUMMS Introduction Manual, p. B-10-4.

Subsystem 13 - Controlled Item Management

> The Controlled Item Management Subsystem contains complete assets data for principal items and depot reparables. Requisitions for these items are computer screened to determine if filling of the requisition would exceed the allowance of the requisitioner. If the requisition passes the check, it is pricessed further. If not, it is suspended for manger action. The subsystem contains a complete range of allowance-type requirement data needed in the development of provisioning, war reserve, and applications requirements. It provides the data needed to prepare budget stratification reports for appropriation stores account (ASA) items.[1]

It is designed to satisfy the DoD requirement that every military service utilize a computer system to continuously reveal the "materiel readiness status" of approved forces. This entails the capability for rapid calculations of total Marine Corps objectives and rapid changes in logistical standards.

To carry out this task the system has certain basic objectives. It must be able to CONTROL principal items, secondary reparables, and ready-line equipment. It must have a knowledge of "in-use" assets and be able to determine requirements based on end item density. In addition, it must be able to compare on-hand assets to the total Marine Corps objectives and also provide management with current reports.

This subsystem also has several interfaces with other subsystems as well as with customers. From Inventory Control, input consists of requisitions, MROs, MRDs, and cancellations, while subsystems 08 and 10 provide file changes. Headquarters, Marine Corps furnishes Activity Codes.

Output consists of requisitions and related transactions to Inventory Control, Quarterly Asset Listings to Headquarters, Marine Corps,

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[1] Ibid., p. B-11-3.

and Quarterly Controlled Item Inventory Reports to FMF commanders. For the customer, output is generated in the form of verification of allowances and management and verification of assets reports.

Overall, the subsystem has essentially two key features. First, materiel planning studies are automatically produced by the computer. Secondly, it provides a complete picture of all assets regardless of location.

Subsystem 14 - Budget Data (Stratification)

> The Budget Data Subsystem extracts, accumulates, and projects basic data which is summarized in different ways for various budget and financial management reports. Materiel requirements and financial assets are collated into an accurate determination of deficiences by time-sequencing. The product of this system is coherent, justifiable requests for peacetime operating stock funds and mobilization funds. It is supported by a variety of prescribed and internal analysis. This subsystem also accumulates, analyzes, retains, updates, and projects provisioning funding requirements for new end items. It produces a refined, workable budget document which includes gross requirements, net funding requirements, and a sales forecast. After funds are made available to the ICP, this subsystem provides the analysis needed to evaluate each funding forecast.[1]

Input into this subsystem comes from a number of sources. The Master Inventory File provides item management and on-hand asset data. Requirements and required delivery dates are supplied from the Project Requirement File. Due-in asset data comes from the Document Control File. The anticipated serviceable returns are used for non-reparable items input; while reparable item input comes from the anticipated unservicable returns.

The processing of input begins by classifying items in one of four inventory management segments; insurance, provisioning, reparables, or non-reparables. Following this a quantitative item matrix is developed for each

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[1] Ibid., p. B-15-3.

item. The item matrix is then converted to a dollar matrix which in turn is subjected to predetermined criteria for selective item review.

This process generates a number of distinct products. First, it prints out dollar summaries by selected inventory management segment, materiel category, and stores account. In addition to these products, some or all of the followig are also produced: selected item matrices; excess asset offers to Defense Logistics Supply Center (DLSC); rollback asset offers to DSA; requirements to DLSC; War Reserve deficiency list; MILSTRIP requisitions for DSA managed War Reserve deficits; apportionment-year shopping list; disposal directives; and selected statistics.[1]

Subsystem 15 - Special Programs

> The Special Programs Subsystem is designed to give the program manager one place to look to for control, cost information, and status of his program. Special programs in the subsystem include Assembly/Disassembly, Modification, Modernization, Alteration, Research and Test, Government-Furnished Materiel, Recoverable Items, Collateral Equipment, Ready Line Materiel, Project Plus, and Loans. Miscellaneous management projects are added to this subsystem as the need occurs.[2]

As stated above , the key feature of this subsystem is better control for the manager, both item and project control if required. This control exists because of the immediate access to query files and receipt of information generated by the Stores Accounting, Depot Maintenance Management and MOWASP Subsystems. Information is supplied on an exception basis to enable the manager to take corrective action. In addition to the exception data and file inquiry replies, the manager is provided cost data and project completion notices.

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[1] "Stratification Subsystem 14," MUMMS Executive-Supervisory Training, September 1967, pp. 2-4.

[2] U.S., Department of the Navy, Headquarters, Marine Corps, MUMMS Introduction Manual, p. B-13-3.

As stated above the key feature of this subsystem is better control for the manager, both project and item control if required. This control exists because of the immediate access to query files and receipt of information generated by the Stores Accounting, Depot Maintenance Management and MOWASP Subsystem. Information is supplied on an exception basis to enable the manager to take corrective action. In addition to the exception data and file inquiry replies, the manager is provided cost data, and project completion notices.

Subsystem 16 - Supply Management Information

Because of its complexity, MUMMS

> ...needs a focal point for collecting useful data from all of the subsystems and for collating it into meaningful reports for management personnel. The Supply Management Information Subsystem is designed to fulfill this vital role within MUMMS. This subsystem will incorporate all of the processes and procedures necessary to support this centralized materiel management approach. Each subsystem design includes processes for generating prescribed output to this subsystem (SS16). All of this data will be collected in the SS16 data bank, from which it will be retrieved for integrated processing on schedule. The initial subsystem design has pointed the need for integrated reporting in four areas...[1]

The four areas which are alluded to above are MILSTRIP and MILSTRAP Workload Analysis, Readiness Reporting and Control, and Financial and Management Analysis. The first two areas are concerned primarily to supplement and fulfill DOD reporting requirements in conjunction with MILSTEP. The third reporting area is focused on maintaining information centrally on the readiness of field activities. The final area attempts to incorporate data from the 15 subsystems into an integrated financial report.

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[1] *Ibid.*, p. B-14-3.

Under the MILSTRIP Workload Analysis, reports are segregated by issue priority group in three areas; stocked items, non-stocked items and consolidated stocked/non-stocked report. The first of these is further broken down by selected workload data and supply management data.

MILSTRAP Workload Analysis formats are not as yet fully developed but the financial and management analysis area provides a number of examples. Initially, report formats were designed to cover sales analysis by commodity, sales analysis by commodity and customer, analysis of non-reimbursable issues by commodity and customer, analysis of fractionated sales, and analysis and procurement program forecast.

These analyses can be utilized for a number of purposes. Among these are:[1]

(1) analyzing current sales trends by both commodity and customer appropriation;

(2) comparing current sales with current sales forecasts for both commodities and customers;

(3) comparing current sales trend with prior sales trends;

(4) provide a basis for adjusting both commodity and customer operating budgets;

(5) develop statistical data on losses or non-reimbursable issues;

(6) adjust funding requirements by comparing actual procurements with the procurement forecast; and

(7) recommend changes in billing procedures by developing statistical data on sales volume by range.

Subsystem 17 - Allotment Accounting

The Allotment Accounting Subsystem is a completely automated system which will record funding data from the time the ICP initiates a requisition until its funds are liquidated. This subsystem will provide up-to-date

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[1] Ibid., pp. B-14-13 to B-14-17.

> information on funds allotted to the ICP on an accelerated basis, including the recording of necessary funding data from computer-generated-buy recommendations, manually generated buy recommendations, direct delivery buy notices, and MILSTRIP requisitions. In addition, it will provide techniques for monitoring funds to ensure that over-commitments/obligations do not occur. The allotment file and other associated files furnish all necessary data for the preparation of reports for local management and for submission to the Commandant of the Marine Corps (Code CHE).[1]

This subsystem utilizes both on-line and off-line processing. On-line transactions include authorizations and transactions and are processed to the Master Allotment file immediately upon receipt. Other transactions, such as obligations, expenditures, and adjustments, are accumulated on tape and scheduled for processing during the time allotted for this subsystem.

There are two processing routines followed by this subsystem -- edit and reconciliation. The edit routine consists of verification of the validity of data contained in the transactions. Output from this verification is in the form of either reject printouts or key punched and interpreted cards. Reconciliation applies to transactions involving expenditures. These transactions are extracted and checked to determine if the dollar value of the details is equal to the dollar value of the summary prior to processing it against the records. In this case, there is either a printout of unreconciled transactions or key punched and interpreted cards.

Daily, the system generates a Status of Allotment report and a trial balance for HQMC and local management. The Status of Allotment report breaks funds down by purpose code within fund code and also by percentage. The trial balance presents a summary of the allotment status by appropriation and subhead within fund code.

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[1] _Ibid._, p. B-15-3.

On a monthly basis, there are reports on the status of funds authorized, both summary and detail, and expenditure listings. In addition to these, interdepartmental billing and the Navy Comptroller Register Reconciliation is produced once a month. Moreover, periodic reports are generated on outstanding commitments and outstanding obligations.

The Allotment Accounting system is utilized primarily to provide an audit trial for all Marine Corps funded transactions. Also incorporated into the system are means for checking balances, avoiding duplication, reserving funds for future use, or restricting commitments.

There are certain features which are inherent in this subsystem. Among them are the validation of funds at all times, the processing of all transactions on an automated basis, which decreases the processing time, and the providing of management with up-to-date and accurate reports.

From the preceding description of the various subsystems, the complexity and sophistication of MUMMS becomes more readily apparent. These descriptions were, necessarily, only thumbnail sketches of the subsystems, but by setting forth the concepts and key features of the components a better feeling for the overall system can be generated.

The narrative on the subsystems is conspicuously lacking for its omission of the Inventory Control Subsystem. The majority of the subsystems are in various stages of operational capacity. Only Inventory Control has been almost completely operational since the implementation of MUMMS.

This fact, and also that it is the key subsystem upon which the operations of the other subsystems rely, makes it the most practical measure of the overall system effectiveness to date. For this reason, the following

chapter will delve into the Inventory Control Subsystem and examine not only its concepts but also its actual performance.

VI. INVENTORY CONTROL SUBSYSTEM: A LOOK AT MUMMS IN OPERATION

The Inventory Control Subsystem is the key to the operational effectiveness of MUMMS. Within this subsystem, centralized control is exercised over stocks, issues, receipts, and determination of requirements. The dependence of the other subsystems is depicted pictorially on page 57. A narrative presentation of its interrelationship with the other subsystems can be found in Appendix C.

Looking at the total subsystem there are several notable features. It, first, has the capacity to operate in a real time environment if circumstances warrant. Closely allied to this ability is that of rapid communication between the ICP and RSAs and various customers through the use of AUTODIN and remote devices. The advantages of real time would be lost if the resultant input/output could not be received and disseminated in times compatible with processing time.

In addition to these abilities, there are several other key features worth mentioning at this point. Among these are the capabilities for complete control of requirements, forecasting demands with automatic trend correction and automatic borrowing of reserved assets.

As mentioned in the previous chapter (pp. 60-61), MUMMS has the ability to segment assets by purpose, condition, and location. This segmentation is accomplished within the Inventory Subsystem.

Into this subsystem's files all requisitions are funneled and output is generated for all but three of the fifteen operational subsystems. To give a somewhat clearer picture of the magnitude of its operations, let us examine the four functions performed by Inventory Control: Stock Control, Receipt Control, Issue Control, and Requirement Control. Moreover, we will look at the process of file maintenance.

Stock Control

Stock control as practiced within the Inventory Control Subsystem covers a great many areas. There are basically five functions, or if you prefer, steps, undertaken for stock control purposes.

The first function is to forecast demand. Basically, actual demand is converted to an average and these averages are utilized for determining stock levels, which is the second function of the subsystem.

Having determined the levels required, a third function is undertaken, replenishment review. This function is concerned with when and how much to reorder.

The next step is to make any necessary adjustments which might result. Adjustments can be generated by changes in inventory, condition codes, or any number of similar occurrences.

The final function covers any areas which do not fall under one of the above mentioned functions. These might be supportability tests for project managers or 90-day Buy forecasts.

Demand is forecast periodically and the computer is programmed to do this forecasting automatically. Forecast codes are assigned to various items which call for monthly, quarterly and even six-month forecasts.[1]

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[1] "Inventory Control Subsystem: Stock Control", MUMMS Executive-Supervisory Training, September 1967, p. 1.

To measure the effectiveness of these forecasts, actual demand is accumulated from records at all the storage facilities, according to Demand Code (e.g. Recurring, Non-Recurring, Recurring plus Non-Recurring, etc.). These data are the product of requisitions, passing orders and Supply directives.

Once this information has been collected, it is compared with the forecast quantity for the last period to determine the deviation. This deviation is averaged with the average deviation of the last period and results in the Mean Absolute Deviation (MAD). This figure is the expected deviation between demand and forecasted demand for the next period.

Every forecast period, all of these deviations are accumulated. The computer then checks to see how many MADs are contained in this collection. This is called the "Tracking Signal".[1]

The Tracking Signal is then compared to the Tracking Limit. This is called a Tracking Analysis and the limits used vary according to the demand weighting factor used. (See Appendix D)

Results from this analysis are handled in one of several ways. If the limits are not exceeded, then a normal demand weight is used for weighting current demands. Should the signal exceed the limits, but both the track and signal sign are moving in the same direction, the demands are given a higher weight.[2]

If the signal exceeds the limit and the signal and limit are moving in opposite directions, the current demand is suspect. In this case, the current deviation is compared with four old MADs which are considered improbable. If this error is greater, the current demand figure is ruled

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[1] Ibid.

[2] Ibid., p. 2.

out and the old data is used. Should it be less, however, the demand figure is accepted as is and the item is then forecasted.

After completion of this stage, single and double averages are computed by a double exponential smoothing process which contains a trend application. Both averages are smoothed to give the forecast quantity. This smoothing is applied to one of the four basic demand patterns: random, impulse, ramp-up, and step.

Stock levels, like forecast demands, are handled within the computer. The determining factor is, as might be expected, the forecast quantity. This level might be in months or in actual numbers depending on the items Requirement Code. These codes give limits for safety levels, lead time and procurement quantities (See Appendix D).

In addition to the prescribed safety level, a service function type of safety level is also used. This is concerned with confidence level, deviation of demand, leadtime and size of the order quantity.

The size of order quantity is determined by an economic order quantity (EOQ) formula if the Requirement Code calls for it. The EOQ takes into consideration the annual dollar demand and any cost restraints included in the cost to order. Such constraints might be MILSTRIP, MIPR, Contracts and Purchase Orders.[1]

In addition to these there are also reorder points, requirement objectives, stock adjustment periods, and retention levels. The latter two are used to determine how much of an item to retain and how much to report as a potential excess. Short shelf life and terminal items are considered for these levels to insure items are not stocked which have no use.

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[1] Ibid., p. 3.

There are three other levels calculated which are worth mentioning. The first is fixed levels, and these are determined manually by the item manager and updated by him. A second is the active provisioning requirement. This represents operational requirements for new equipment during the provisioning cycle. Once the cycle is completed, these requirements revert back to normal system demand.

The last level which we will consider is the reparable type items. Data used to compute requirements are the unserviceable returns. A certain percentage of these returns are expected due to attrition. This rate of washout is used to determine the repair rate. Repair cycle time is then used to compute requirements while the washout rate determines leadtime, procurement, and retention stocks.

Replenishment review, unlike forecasting and computation of stock levels, is done on a daily basis. Any time a change in assets or requirements is registered, the computer automatically conducts a review.

This review consists essentially of a comparison of the total assets to the reorder point. (ROP) If the assets are equal to or less than ROP plus obligations, the computer automatically produces a buy transaction if the item is funded.

The comparison of systems assets to ROP is done first for the individual RSA's. Averages at one RSA are applied to shortages. Although stock levels are computed on a system wide basis, an allocation factor, based on demand at each RSA, is used to determine which portion of the requirement objective is applicable to each RSA. In this manner the net shortages of the total system are arrived at.[1]

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[1] Ibid., p. 3.

Throughout this review, the computer looks for items that have turned "hot". Hot requirements are those for which the requirement date is one procurement lead time, or less, away. Normally, budget provisions restrict the purchase of any item more than one procurement lead time in advance of when it is needed.

If the requirement is for an item that is deficient, it is automatically procured if it is funded. If it is not funded, a deficiency report is produced for the item or project manager. Should the requirement be for an item which has stocks in the retention level, it will be supplied from this, regardless of whether the item is funded or not.

If a buy transaction is produced, the due quantity is recorded in the appropriate file, funds, if available, are committed, and the transaction is recorded in the Document Control File. Buys are automatically routed to the supply source if the source is military, or to the Procurement Office if it is commercial.

The Adjustment process is a fairly simple one. The initial step in the process is a physical inventory at the RSAs. These inventories might be a result of warehouse denials, manager direction, or cyclic requirements.

During the inventory period, a Freeze Code is entered into that portion of the inventory record for the particular RSA(s) under consideration. Sometimes this only freezes the issue of certain priorities but on occasion the entire RSA(s) record is completely frozen.

After the inventory has been completed, the Freeze Code is removed from the records, adjustments are made to the balances, and the normal replenishment review is undertaken.

Any gains or losses are transmitted to the Stores Accounting Subsystem. Other adjustments might include re-identification of stocks

in which an erroneous mixture of stocks has been recorded. This type of transaction must have offsetting gains and losses. There are also adjustments to indicate changes in segmentation. All of these adjustments, however, are subject to Control Codes for item manager review.

Receipt Control

There are several distinct functions which come under the concepts of receipt control. The first of these is buy recommendations (BRs). These BRs can be either automatic or manual. Manual BRs are limited to system stocks but the automatic BRs can also include direct delivery.

Another area under receipt control is that of due-in transactions. The transactions can be MILSTRIP/MILSTRAP requisitions or from commercial sources. In addition, shipment status from both sources, as well as supply status from MILSTRIP, is monitored under the portion of the Inventory Control Subsystem.

The real heart of this receipt controls operations is the processing of all receipt transactions. It generates output to the MOWASP subsystem to provide up-to-date information for efficient storage planning. Moreover, it releases backorders, provides credit to its customers for turned-in equipment, and handles any variances in the expected receipts by exception reports.

Receipt control also encompasses cancellation requests and replies as well as requests and responses for reconciliation of dues.

To clarify its operations even more, the following is a list of the output generated by receipt control:

(1) Prepositioned Receipt Cards (MOWASP)
(2) Direct Delivery Status
(3) Exception Reports (Variances)

(4) Status Reports

(5) Rejects

(6) Stores Transactions

(7) Shipment Status to Customers

(8) Replies to cancel requests to customers

(9) Cancellation requests to suppliers.[1]

Issue Control

Issue Control is tied in almost exclusively with the requisitioning process and, therefore, MILSTRIP. It is this segment of Inventory Control which processes all requisitions and passing orders.

Along with the processing or requisitions, issue control generates Materiel Release Orders, and receives and processes Materiel Release Confirmations and Materiel Release Denials. This process was discussed in the beginning of this chapter.

Added to these functions are those of requirement releases, supply directives, and redistribution orders. Also, direct delivery buys are generated for priority one through eight requisitions while backorders, both automatic and manual, are established for priority one through twenty requisitions. In connection with backorders, issue control also handles any reconciliations or releases. There are also provisions within this subsystem for follow-up and modifications of MROs.

Upon receipt of a requisition, it is first screened for order of use by FSN. This takes into consideration the I & S Program.

It is then examined to determine the order of issue by RSA. The demand is also recorded at this point.

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[1] "Inventory Control Subsystem: Receipt Control", _NUMMS Executive-Supervisory Training_, September 1967, p. 5.

Once this has been decided, asset availability is then determined. This takes into consideration the purpose code and condition code of the item.

Following this the record is updated and the issue exits the system. The issue takes the form of either an MRO, a buy (priority 1-8), a back-order (priority 9-20), or a cancellation (controlled item which exceeds allowance).

Requirement Control

The two basic concepts under this are the determination of hot and cold requirements. This is determined by whether the item required is less than or greater than one procurement lead time away. Requirements are also segrgated by funded or unfunded.

This section is also the controlling factor over the addition or subtraction of requirements totals. In addition, items are deleted or replaced by Requirements Control.

Supportability tests are another area which this section is responsible for. These tests show attained hot/cold requirements and unattained hot/cold requirements. Moreover, it handles requirement releases. This is done by either FSN or by project.

As in all of the sections of Inventory Control, there is a distinct number of outputs generated by Requirements Control. These consist of acknowledgements, status, attainment/deficiency reports, exception/status reports and rejects.

Input for the determination of requirements comes from many sources. Some of these sources are General Mobilization Reserve (GMR), Prepositioned War Reserve (PWR), Specific Plans, Military Assistance Program (MAP), Provisioning, Loans, Protection and Maintenance, and Assembly/Disassembly.

File Maintenance

Basically, there are two steps in maintaining the computer files of the Inventory Control Subsystem. These are file changes and file review.

File changes are directed at Phrase Codes, unit of issue, standard unit price, SMRC/Retention Code, miscellaneous identification/management data, order of use table, and Master Header File (MHF) update output. These changes are made in the Master Inventory File but loads, replacements, and deletions are also made to the Customer Index File.

Reviews are conducted daily, weekly, monthly, and even annually. Master Inventory File reviews, which are on data cells, consist of item exit dates, source codes, phrase code candidates, and inactive items. The MHF review, which is a duplicate of the MIF on tape, is planned to focus on data compatibility, record purification, management analysis, and statistical review. Document Control File reviews are scheduled for pending receipt follow-up (daily), backorder status (weekly), and problem backorders (monthly).

In addition to these, a Suspense File follow-up is conducted daily. There are plans for a THF Procurement Lead Time (PLT) review as well as a Reject File error analysis review.

MUMMS Effectiveness

The above information is a conceptual presentation of how the subsystem, and closely tied to it, MUMMS, are supposed to operate. The question still remains, have they lived up to their promises.

This question cannot be answered with a plain, yes or no, answer. In some areas it has met expectations. Overall, it has experienced a lot of growing pains.

Key personnel at Headquarters, Marine Corps and Marine Corps Supply Activity, Philadelphia, are divided in their evaluations. Headquarters personnel, as a whole, expressed a somewhat skeptical viewpoint of the system. Conversely, those at Philadelphia were optimistic about the system.

The chief complaint seems to stem from a financial reporting aspect. Reports are late and do not accurately reflect the financial status of obligations or expenditures.[1]

At the present, there has been little success in reconciling the stores accounting and inventory figures. There are two prime examples of this. The RSA records for Quantico reflect an inventory of $4.1 million while actual inventory is only $2.6 million. This shows the great lag in reporting time.[2]

Another example is the deficiency between the Inventory Control Subsystem and the War Reserve Subsystem. A selected sample of some 37 items, which was approximately 30% of total assets, showed an $18 million difference between Inventory Control and War Reserve.[3]

Somewhat of a paradox is that the relatively large percentage of backorders has not generated any increased complaint from field activities about inadequate supply support. This can possibly be explained by the partial assumption of responsibility by the Navy and Army for supplying a number of common items in Vietnam. Also, the supply buildup prior to the

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[1] Interview with Mr. Tony Varano, Financial Management Branch, Headquarters, Marine Corps, March 8, 1968.

[2] Interview with LtCol Calvert, Financial Management Branch, Headquarters, Marine Corps, March 8, 1968.

[3] Interview with Mr. Jack Bluim, Inventory Management Branch, Headquarters, Marine Corps, March 8, 1968.

implementation of MUMMS may have accumulated sufficient stocks to support operations satisfactorally, independant of MUMMS.

It was generally agreed that one of the major obstacles for a smoother operating system was the unsuccessful conversion process for requisitions submitted prior to the implementation of MUMMS. Many of these requisitions remain unconverted to date, with the result that sales for stock fund items have dropped despite forecasts of increased demand. Such discrepancies result in the cut back of funds for Stock Fund items.

Considerable skepticism was directed toward the area of forecasting demand. Some contended that the system was too sophisticated in this respect and often resulted in unrealistic forecast trends. An example was the forecast for sleeping bags which showed a monthly forecast quantity of 4000 but a negative trend to zero. It was also felt that trend errors, when they did occur, tended to multiply themselves as shown by a forecast demand of $60 million for dry cell batteries. Not only were these figures on the excessive side, but there were also unrealistic projections on the deficiency side of the ledger.[1]

The ultimate result of these shortcomings is felt most keenly in the budgeting area. In a time when funds are scarce and justification criteria are stringent, the system does not seem to be providing timely or accurate data.

Most of the personnel at Headquarters concurred that the majority of the problems stemmed from bad data going into the system and bad data already within the files. There is presently a concerted effort upon the part of the ICP personnel to clean up the computer files and have the system on a more effective basis by July 1968.

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[1] Ibid.

The majority of the people interviewed expressed satisfaction with the design of the system itself. Many felt that perhaps the Marine Corps might have eased into the system a little more slowly and under more advantageous situations. The urgency, however, seemed to generate more concern for supply support than the fiscal and accounting aspects of the system. This was probably the cause of the bad input. Instead of stepping in a little at a time and letting one fuse blow at a time, the Marine Corps jumped in with both feet and all the fuses blew at once.

Customer satisfaction, however, does not seem to have degenerated, as was mentioned earlier. Requisition status and supplies were more timely in Vietnam than ever before.[1] The supplies might be explained by the influx of stocks prior to MUMMS, but status to the customer has been more responsive since MUMMS was implemented.

The shortcomings were becoming more obvious but this was to be expected in a growing system of such magnitude. Once it has shed its growing pains, the system should more effectively fulfill its promise. Handling requisitions at a rate of 20-30,000 per week does not leave a great deal of time for debugging operations. Progress is being made, however, and time will provide the answer.

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[1] Interview with Captain David D. Gillespie, former Supply Officer, 9th Motor Transport Battalion, Third Marine Division (FWD), December 18, 1968.

VII. SUMMARY AND CONCLUSIONS

The process from which MUMMS evolved was the culmination of almost two hundred years of tradition and experience. It was not an easy transition for an organization which had long prided itself on the dominance of 'esprit de corps' over any problem. It was a necessary transition, however, and once the necessity became known, the Marine Corps acted vigorously and positively.

Since its earliest years, the field of supply and logistics had taken a backseat to the more alluring promise of reward offered in the combat arena. The ability to survive on 'table scraps' was ingrained into each and every Marine. Spirit and loyalty were the only necessary 'supplies' for the fighting Marine.

Time, however, greatly modified this concept. Automation was making itself felt everywhere. Hand-to-hand combat was no longer the order of the day. Highly sophisticated weapons systems were appearing everywhere and with them, highly sophisticated management philosophies were coming into being. A good Marine might fight without food or ammunition but a weapon was useless unless it could be properly supported.

The size and scope of the Marine Corps Supply System has steadily increased over the years. The support provided in World War II and the Korean War was a tribute to human ingenuity. These two wars, however, had a more notable impact on the Marine Corps Supply System.

Although the Supply System performed admirably, it had become apparent that the growing Marine Corps would need an even more responsive supply system than ever before. Human effort could not be relied upon to supply all of the needed support.

For this reason, the Marine Corps mechanized its system in 1952. Growing requirements for speed, coupled with increasing advances in machine capabilities, led the Marine Corps to automate its supply system in 1959.

More so than ever before, the "sixties" placed an added emphasis on speed and accuracy. With weapons capable of inflicting total destruction from thousands of miles away, time was a valuable commodity. Economic factors were also added which meant efficiency, as well as effectiveness, had to be an integral part of any system, new or old.

These were the motivating factors which prompted the Marine Corps to revise its already highly automated supply system in late 1963. Out of this revision, the Marine Corps Unified Materiel Management System was born.

Integrating sixteen subsystems into a highly sophisticated and automated system of supply management, MUMMS was designed to take advantage of the latest developments in computer technology and inventory management techniques. It was designed to be compatible with existing Department of Defense systems as well as to incorporate standard DOD programs such as MILSTRIP and MILSTRAP.

Implementation, which was scheduled for early 1966, was postponed on several occasions, but on May 1, 1967 the system finally came into being. The design and development stages had been long and tedious but the benefits expected to be derived were thought to be well worth the effort.

When MUMMS was still on the drawing board, and even after its ultimate design had been approved, performance was still a matter of conjecture. Theory is only as good as far as it takes you. Actual performance is the ultimate test of any system.

After almost ten months, MUMMS is still not 100% operational. There is even debate as to what constitutes the measure of whether a subsystem is operational or not. This fact not withstanding, MUMMS has produced some measureable results, and an early, if not complete, evaluation is possible.

Conclusions

That MUMMS has had an impact on inventory management within the Marine Corps is an immediate and undisputable observation. Whether this impact has proven to be a favorable or detrimental one is not quite so readily apparent.

Without first debating the individual merits, what have been the overall effects of MUMMS? What concepts has it introduced?

The most obvious effect has been the recentralization of authority at the ICP level. Prior to MUMMS, the Marine Corps Supply Centers, with the Stock Accounts as extensions, were the hub of supply activity within the Marine Corps.

This recentralization is a natural outgrowth of the same trend in the Department of Defense which existed under former Secretary of Defense MacNamara. Moreover, the standardization of procedures throughout the Defense establishment necessitated a more centralized direction of Marine Corps activities.

Equally as apparent has been the increased reliance on automation. This is in part tied into the trend toward more centralization mentioned above, but it also stemmed from a need for a more timely and responsive

supply system. The pace of modern warfare has been reduced from a time frame of days to that of seconds and support elements must react accordingly.

The need for accuracy in current supply procedures, as well as in planning future commitments, resulted in the third effect; the adoption of advanced mathematical and management techniques.

Complex weapons systems do not lend themselves well to outdated mathematical techniques for forecasting requirements. Many new techniques have evolved, however, over the last few decades. Proper utilization of these techniques was dependant, nevertheless, upon the development of computer technology. A merger of the two, however, was a necessity for managing sophisticated weapons systems, as well as large, mobile, and diversified forces of men and materiel.

Management by exception was a cornerstone in the design of MUMMS. No amount of manpower, no matter how dedicated, could exercise day-to-day surveillance over every aspect of the complex supply operations needed to support the Marine Corps. For this reason, it was necessary to eliminate from consideration the routine occurences and concentrate on those of an extraordinary nature. This feature was built into MUMMS.

The latter part of Chapter VI examined some of the more explicit results of MUMMS. The majority of these did not seem to reflect too advantageously on the overall performance of MUMMS.

These results, however, should be placed in their proper perspective. The presence of these shortcomings does not appear to be directly attributable to the system itself.

The design and concepts which have gone into MUMMS are essentially sound ones. The trouble seems to lie in the timing of implementation. With the war in Vietnam, emphasis, as might be expected, was placed on supply support; on putting the materiel in the hands of the troops.

This was what the system was ultimately designed to do. Unfortunately, the urgency of the ultimate goal seemed to obliterate the importance of the steps in between -- primarily the accounting and reporting aspects. Forgotten in the haste was the old axiom that "a chain is only as strong as its weakest link."

Input into the system has been inadequate at best. As a result, reports for financial accounting and control are late and inaccurate. These are some of the very reports with which the Marine Corps must go to the budget table to substantiate the need for funds; funds which are needed to procure the necessary materiel.

Some of these pitfalls might have been avoided, or at least softened, had the system been eased into stage by stage. Additionally, the lack of adequately trained personnel, which seems to be one drawback, might have been overcome.

On the other hand, the system seems to generate better control for overall assets. With stock level determination and procurement under one roof, their actions can be coordinated to produce a more realistic and accurate requirement picture.

Perhaps most important of all, there seems to be more command awareness of supply procedures. Whatever the reasons, this is a vast improvement over past supply systems. Whether this awareness was predicated on a critical or favorable viewpoint of MUMMS is not the important consideration. The important point is that they have an interest to see that MUMMS performs its mission in an acceptable manner.

As of now all of the facts are not in. Perhaps the most important of all is yet to come: the test of time. Growing pains can be expected

in anything as new and complex as MUMMS. The most important thing is to recognize the shortcomings and profit by any mistakes. Attention must be devoted to the "means" as well as the "end".

The principles of MUMMS are sound ones. The output depends, however, on the input. No matter how elaborate or accurate the tools of a system are, it cannot produce the right answers if the wrong questions are asked. Once this phase has been strengthened, MUMMS should live up to its promise to "satisfy all internal and external requirements of the Marine Corps."[1]

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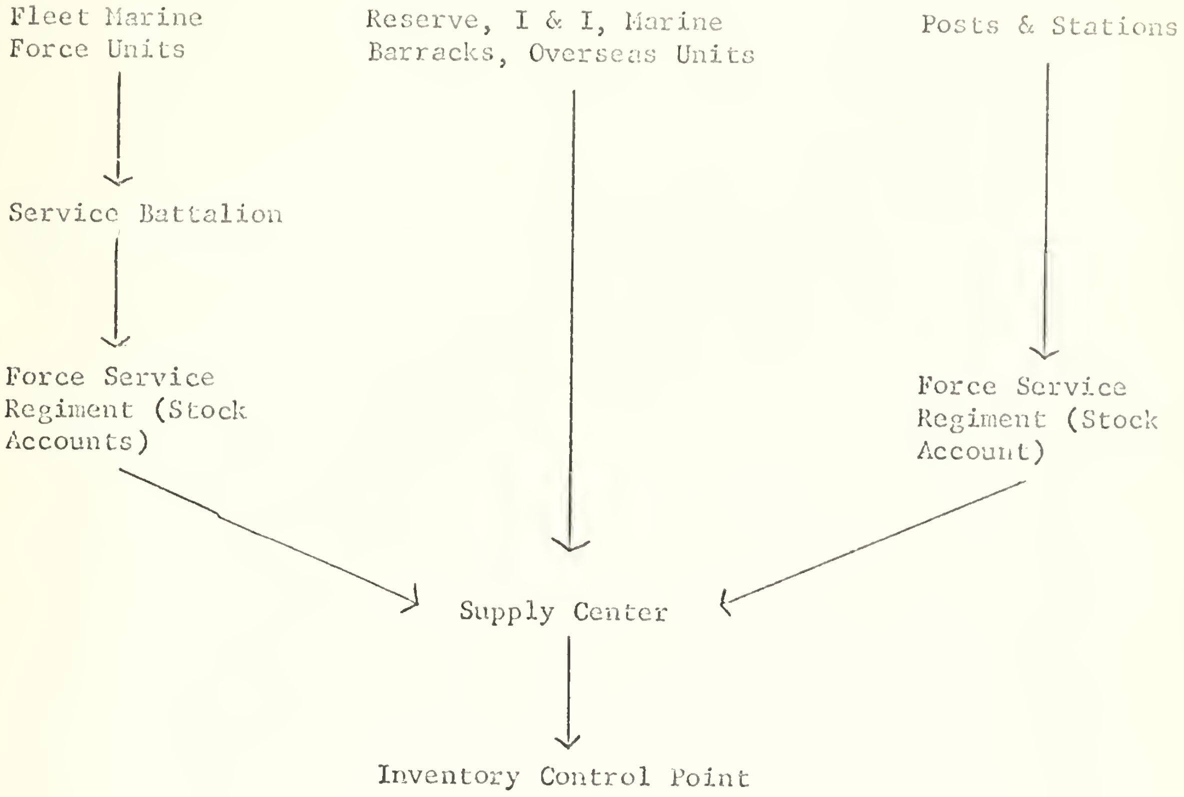
[1] U. S., Department of the Navy, Headquarters, Marine Corps, MUMMS Introduction Manual, p. v.

APPENDIX A

MARINE CORPS SUPPLY SYSTEM
PROCEDURES, FUNCTIONS, AND ORGANIZATION
PRIOR TO
MARINE CORPS UNIFIED MATERIEL MANAGEMENT SYSTEM

NORMAL REQUISITION FLOW

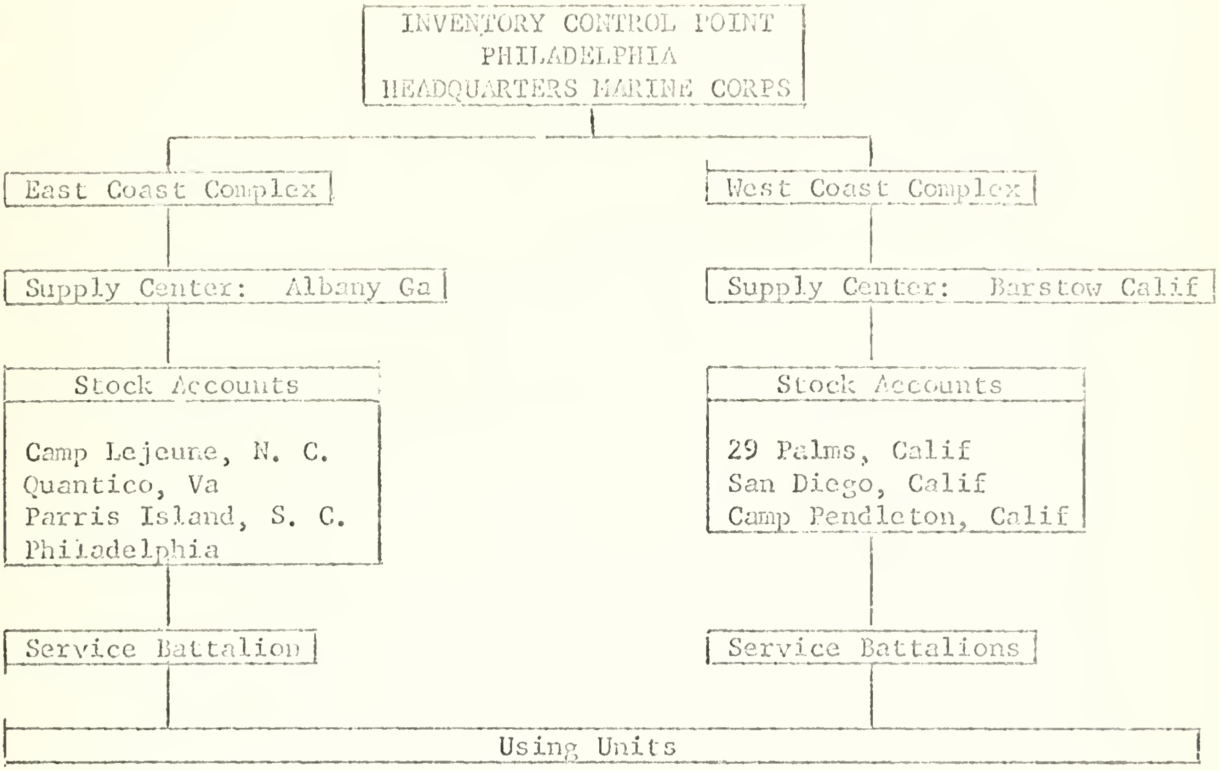

Fleet Marine Force Units
Reserve, I & I, Marine Barracks, Overseas Units
Posts & Stations
Service Battalion
Force Service Regiment (Stock Accounts)
Force Service Regiment (Stock Account)
Supply Center
Inventory Control Point

SUPPLY ACTIVITY FUNCTIONS

Level of Activity	Capability	Procedures
FMF Unit	Manual System	1. Determines need 2. Determines Priority 3. Submits SLIT document to Division Service Battalion
Division Service Battalion	Mobile conventional tabulating equipment	1. Issues materiel desired 2. If not on hand or not stocked and (1) Priority 1-12: passes to Force Service Regiment (2) Priority 13-20: Establishes backorder (3) Requisition desired materiel if due not recorded 3. Determine stock level if new item and advises Force Service Regiment of requirement
Force Service Regiment (Stock Accounts)	Conventional tabulating equipment	1. Issues materiel desired to Service Battalion 2. If not on hand or not stocked and (1) Priority 1-12: passes to Supply Center (2) If not on hand and not a clothing or textile item or decontrolled item (a) Priority 1-12: passes to Supply Center (b) Priority 13-20: establish obligation (3) If not on hand and not decontrolled but is a clothing and textile item: (a) Procure from Integrated Manager (4) If not on hand and is decontrolled item: (a) Procure from General Services Administration or (b) Procure from local sources

SUPPLY ACTIVITY FUNCTIONS (cont)

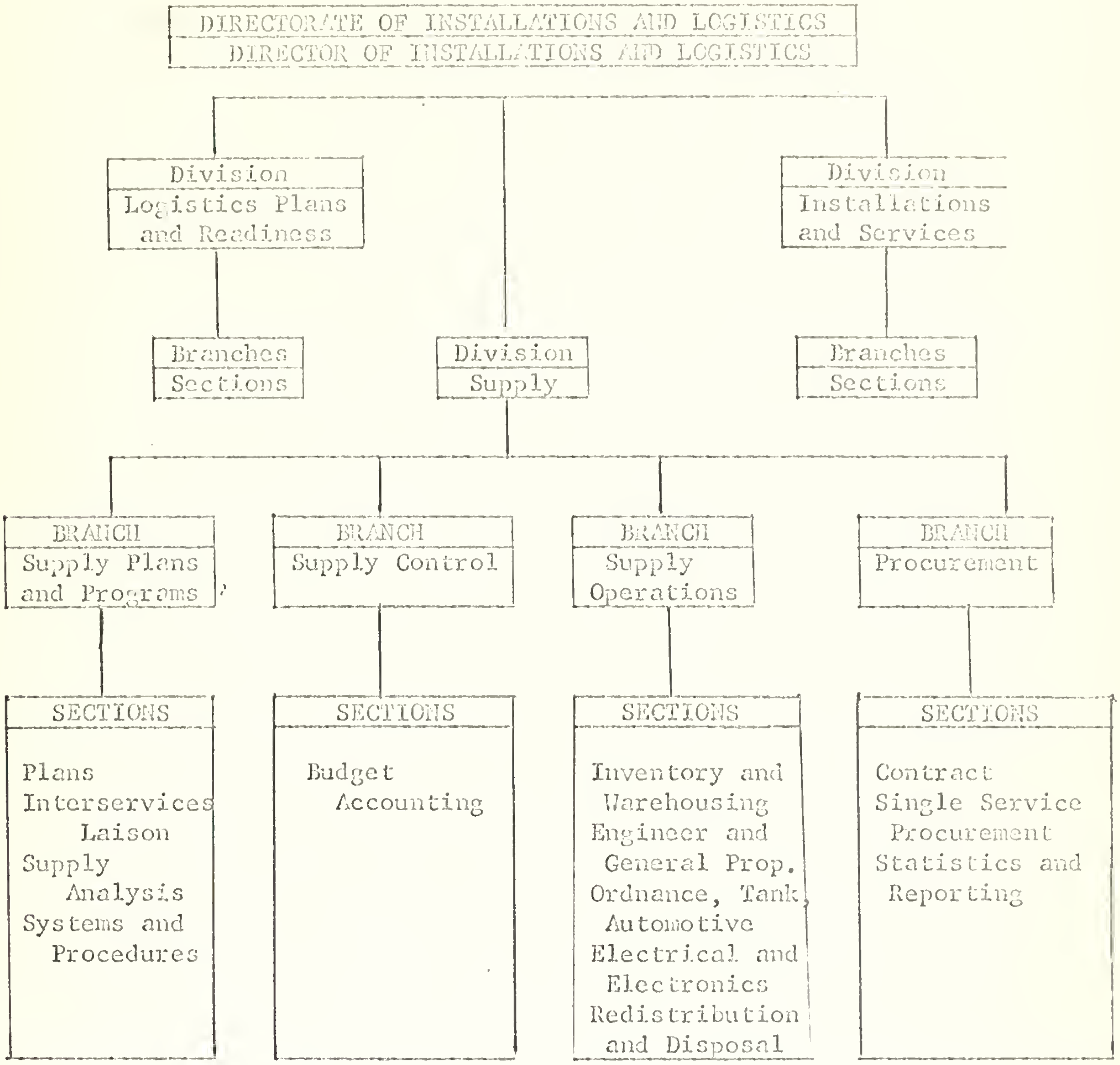
Marine Corps Supply Centers	Remington Rand UNIVAC File Computer	1. Issues materiel desired 2. If not on hand at Supply Center, screen other Complex Stock Accounts for assets and if priority 1-12 direct shipment 3. If not on hand in Complex and (1) Priority 1-12: pass to Inventory Control Point (2) Priority 13-20: Establish Obligation ($) on known due (3) If not due (a) Procure if authorized from 1 Integrated Manager 2 General Services Administration or Local Procurement 4. Determine stock level for Supply Center managed item
Inventory Control Point	Remington Rand UNIVAC File Computer and Solid State 80 Remington Rand Computer	1. Screen stock status report of opposite Complex for assets 2. If available direct shipment (if economical) 3. If not available (1) Procure for direct delivery from: (a) other services (b) Commercial Sources (2) Establish requirement for stock level at either Complex (3) If available from other services (a) Request Services to stock for subsequent support.


INVENTORY CONTROL POINT
PHILADELPHIA
HEADQUARTERS MARINE CORPS
East Coast Complex
West Coast Complex
Supply Center: Albany Ga
Supply Center: Barstow Calif
Stock Accounts
Camp Lejeune, N. C.
Quantico, Va
Parris Island, S. C.
Philadelphia
Stock Accounts
29 Palms, Calif
San Diego, Calif
Camp Pendleton, Calif
Service Battalion
Service Battalions
Using Units

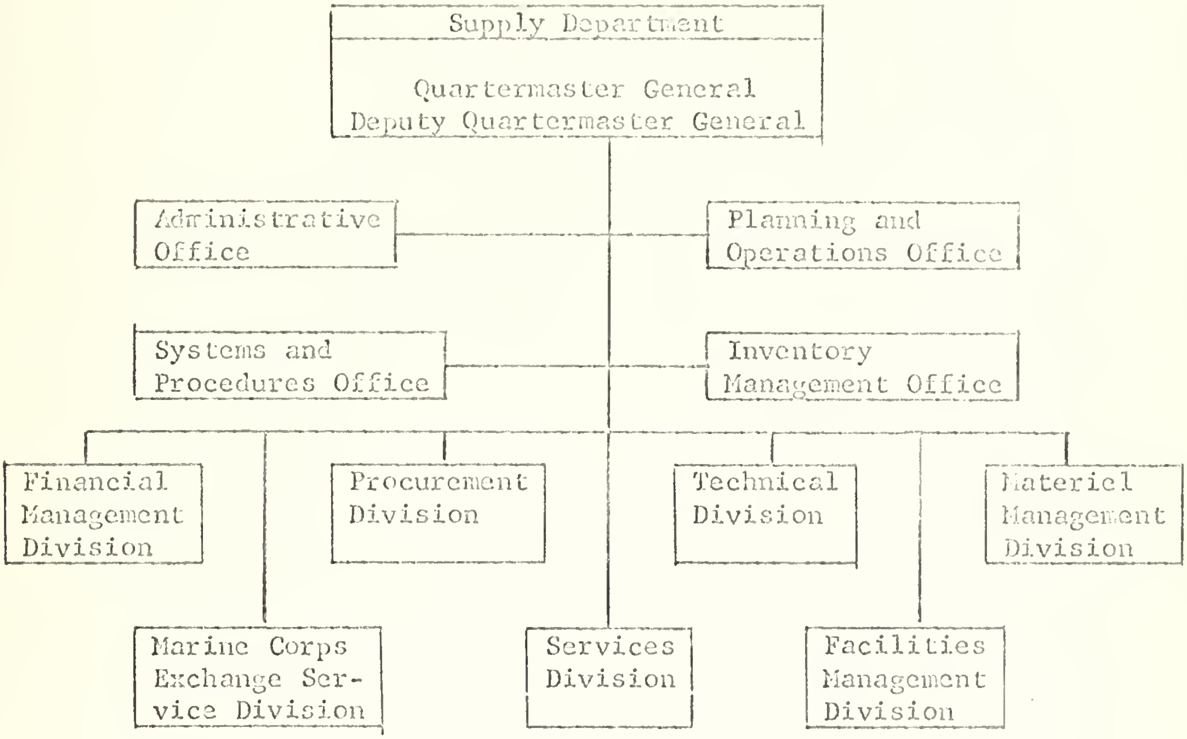
APPENDIX B

HEADQUARTERS MARINE CORPS SUPPLY ORGANIZATION

PROPOSED SUPPLY SYSTEM ORGANIZATION
HEADQUARTERS MARINE CORPS


DIRECTORATE OF INSTALLATIONS AND LOGISTICS
DIRECTOR OF INSTALLATIONS AND LOGISTICS
Division
Logistics Plans and Readiness
Division
Installations and Services
Branches
Sections
Division
Supply
Branches
Sections
BRANCH
Supply Plans and Programs
BRANCH
Supply Control
BRANCH
Supply Operations
BRANCH
Procurement
SECTIONS
Plans
Interservices Laison
Supply Analysis
Systems and Procedures
SECTIONS
Budget
Accounting
SECTIONS
Inventory and Warehousing
Engineer and General Prop.
Ordnance, Tank, Automotive
Electrical and Electronics
Redistribution and Disposal
SECTIONS
Contract
Single Service Procurement
Statistics and Reporting

SUPPLY DEPARTMENT ORGANIZATION
HEADQUARTERS MARINE CORPS


Supply Department
Quartermaster General
Deputy Quartermaster General
Administrative Office
Planning and Operations Office
Systems and Procedures Office
Inventory Management Office
Financial Management Division
Procurement Division
Technical Division
Materiel Management Division
Marine Corps Exchange Service Division
Services Division
Facilities Management Division

APPENDIX C

INVENTORY CONTROL SUBSYSTEM RELATIONSHIP TO OTHER SUBSYSTEMS

INPUT TO INVENTORY CONTROL

RELATED SUBSYSTEM	INPUT
05	PROCESSES DUES AND RECEIPTS CONTROL CHANGES
06	PROCESSES SHIPMENT CONFIRMATIONS AND DENIALS, INVENTORY TRANSACTIONS, AND RECEIPTS
07	PROCESSES REPLENISHMENT REQUISITIONS
10,11,12	PROCESSES REQUIREMENTS TRANSACTIONS
13,15	RECEIVES AND RECORDS CONTROL DATA
17	RECEIVES FUNDS

OUTPUT FROM INVENTORY CONTROL

RELATED SUBSYSTEM	OUTPUT
04	GENERATES UPDATE TRANSACTIONS TO 04 FILES GENERATES BILL INPUT FROM MC ISSUES TO 04 GENERATES RECEIPT TRANSACTIONS FOR RECONCILLATION
05	GENERATES BUY RECOMMENDATIONS FOR PROCUREMENT
06	GENERATES ALL ISSUE TRANSACTIONS TO 06
10,11,12	PROVIDES ATTAINMENT, LOCKUP, AND CONTROL OF ASSETS
13,15	PROVIDES ASSET DATA FOR SUPPORTABILITY
13	PROVIDES ASSET DATA FROM DISTRIBUTION SYSTEM FOR MATERIEL PLANNING STUDIES DD-764
14	PROVIDES ASSET AND FORECAST DATA FOR STRATIFICATION
15	PROVIDES ISSUE/RECEIPT/REQUIREMENT CONTROL FOR CONTROLLED ITEMS
17	PROVIDES AUTOMATIC COMMITMENT/OBLIGATION POSTINGS FOR MILSTRIP OUTPUT AND COMMITMENT POSTINGS FOR COMMERCIAL OUTPUT

Source: "INVENTORY CONTROL SUBSYSTEM", MUMMS EXECUTIVE-SUPERVISORY TRAINING, September 1967.

APPENDIX D

TABLES OF FORMULAS FOR FORECASTING DEMANDS AND COMPUTING SYSTEM STOCK LEVELS

TABLE OF TRACKING LIMIT VALUES

When Two Standard Deviations Are Used As The Tracking Limit

Weighting Factor Values	Tracking Limit
.05	5.7
.10	4.0
.15	3.8
.20	3.0
.25	2.7

Note: To compute tracking limits for other weighting factors or other standard deviations limits, do the following:

$$\text{TRACKING LIMIT} = \frac{1.25\ (\text{No. of Std. Deviations Desired})}{W\ (4-W-4W^2)}$$

Where: W = weighting factor to be used.

TABLES OF FORMULAS & SYMBOLS FOR COMPUTING SYSTEM STOCK LEVELS

1. Monthly Resupply Rate (MRSR) Depot Reparable

a. Formula MRSR = A - B

Where:
A = Forecast Code (In Item Record)
B = ((C+D)-E) - F
C = Current Period Repairs
D = Prior Period Repairs
E = Number of Prior Periods
F = Forecast Code

Note: If MRSR = 0 Omit computations 2 & 6

2. Procurement Leadtime Quantity (PLTQ) Depot Reparable

a. Formula When Requirement Code specifies PLT in Months

PLTQ = A x B

Where:
A = Monthly Resupply Rate
B = Months Specified

b. Formula When Requirement Code Specifies Actual PLT

PLTQ = A(B + C)

Where:
A = Monthly Resupply Rate
B = Administrative Leadtime Months
C = Production Leadtime Months

3. Repair Cycle Quantity (RCQ) Depot Reparable

a. Formula $RCQ = (A \div 30)B$

Where:
A = Monthly Repair Rate
B = Repair Cycle Time

4. Safety Level Quantity (SLQ) Depot Reparable

a. Formula SLQ = Procurement Leadtime Quantity plus Repair Cycle Quantity, the sum of which is applied to the Safety Factor Table for Depot Reparable Items

5. Reorder Point Quantity (ROP) Depot Reparable

a. Formula $ROP = A + B + C + D$

Where:
A = Safety Level Quantity
B = Procurement Leadtime Quantity
C = Repair Cycle Quantity
D = Purpose 'A' Not Requirement

6. Procurement Quantity (PQ) Depot Reparable

a. Formula When Requirement Code specifies PQ in Months

$PQ = A \times B$

Where:
A = Monthly Demand Forecast
B = Months Specified

b. Formula When Requirement Code specifies variable PQ and Echelon Code is 2:

(1) $$PQ = \frac{A\sqrt{B}}{C}$$

Where:
A = MILSTRIP Cost Constant
B = Monthly Resupply Rate x 12 x Standard Unit Price
C = Standard Unit Price

(2) $PQM = A \div B$ (Procurement Quantity in Months)

Where:
A = Procurement Quantity
B = Monthly Demand Forecast

(3) Compare PQM to RCL (Minimum-Maximum Limits) and adjust PQ if required

c. Formula When Requirement Code specifies Variable PQ; Echelon Code is 1; and Procurement Source Code indicates MIPR:

(1) $$PQ = \frac{A\sqrt{B}}{C}$$

Where:
A = MIPR Cost Constant
B = Monthly Resupply Rate x 12 x Standard Unit Price
C = Standard Unit Price

(2) $PQM = A \div B$
Where A = Procurement Quantity
B = Monthly Demand Forecast

(3) Compare PQM to RCL (Minimum-Maximum Limits) and adjust PQ if required.

d. Formula When Requirement Code specifies Variable PQ; Echelon Code is 1; and Procurement Source Code indicates commercial:

(1) $$PQ = \frac{A\sqrt{B}}{C}$$
Where: A = Informal Commercial Cost Constant
B = Monthly Resupply Rate x 12 x Standard Unit Price
C = Standard Unit Price

(2) $PQM = A \div B$ (Procurement Quantity in Months)
Where: A = Procurement Quantity
B = Monthly Demand Forecast

(3) Compare PQM to RCL (Minimum-Maximum Limits) and adjust PQ if required

(4) If PQ is greater than $2500.00, recompute PQ with A = Formal Commercial Cost Constant.

7. Procurement Leadtime Quantity (PLTQ) Normal Demand

(1) This Computation is the same as paragraph 2 with the following exception:

A = Monthly Demand Forecast

8. Procurement Quantity (PQ) Normal Demand

(1) This computation is the same as paragraph 6 with the following exception:

Monthly Demand Forecast is used instead of Monthly Resupply Rate in all formulas.

9. Safety Level Quantity (SLQ) Normal Demand

a. Formula When Requirement Code specifies Safety Level in Months

(1) $SLQ = A \times B$
Where: A = Monthly Demand Forecast
B = Months Specified

b. Formula When Requirement Code Specifies Variable Safety Level:

(1) SLQ = Safety Factor x Mean Absolute Deviation during Leadtime which is computed as follows:

$B - C = A$

$A(E + F) = D$

$\frac{H}{D}(1-J) = G$

Apply G to the Safety Factor Table for Normal Demands and select K.

$K \times D = SLQ$

Where: A = Monthly Mean Absolute Deviation
B = Mean Absolute Deviation
C = Forecast Code
D = Mean Absolute Deviation During Leadtime
E = Administrative Leadtime Months
F = Production Leadtime Months
G = Service Function
H = Procurement Quantity
J = Confidence Level
K = Safety Factor

10. Reorder Point Quantity (ROP) Normal Demand

a. Formula $ROP = A + B + C$
Where: A = Safety Level Quantity
B = Procurement Leadtime Quantity
C = Purpose 'A' Hot Requirement

11. Requisitioning Objective (RO)

a. Formula $RO = A + B$
Where: A = Reorder Point
B = Procurement Quantity

12. Stock Adjustment Quantity (SAP)

a. Formula When Item is assigned Short Shelf Life Code:

$SAP = (A \times B) - (C - D)$

Where: A = Short Shelf Life Code
B = Monthly Demand Forecast
C = Safety Level Quantity
D = Procurement Quantity

b. Formula When Item is not assigned Short Shelf Life Code:

$SAP = (36 - A)(B) - C$

Where: A = Months to date current fiscal year
B = Monthly Demand Forecast
C = Procurement Quantity

13. Economic Retention Quantity (ERS)

a. Formula When Item is assigned Short Shelf Life Code or Retention Level Code other than 1:

ERS = 0

b. Formula When Item is not assigned Short Shelf Life Code or Retention Level Code other than 1:

ERS = 36 x A

Where: A = Monthly Demand Forecast

REQUIREMENTS CODE TABLE

Requirements Code	Safety Level	PLT	PQ	PQ MIN	PQ MAX
01 - 89	Variable	Actual	EOQ	MF-	12MF-
	Reparable	.5 - 6	2MF-	3MF	36MF
	MF	1.5MF-	12MF		
	MF/X	3MF	Fixed		
	Fixed	Fixed			
90 - 99					

Entries are possibles. RC 90 - 99 indicates manual compute item.

MF = Monthly Demand Forecast

SAFETY LEVEL TABLE FOR DEPOT REPARABLES

SAFETY LEVELS BASED ON POISSON DISTRIBUTION DATA (90% CONFIDENCE LEVEL)

Repair Cycle Qty plus Procurement Leadtime Quantity	Safety Level	Repair Cycle Qty Plus Procurement Leadtime Quantity	Safety Level
1	1	144 to 162	16
2 to 3	2	163 to 183	17
4 to 7	3	184 to 205	18
8 to 11	4	206 to 228	19
12 to 17	5	229 to 253	20
18 to 24	6	254 to 279	21
25 to 33	7	280 to 306	22
34 to 42	8	307 to 335	23
43 to 53	9	336 to 365	24
54 to 65	10	366 to 396	25
66 to 79	11	397 to 429	26
80 to 93	12	430 to 463	27
94 to 108	13	464 to 498	28
109 to 125	14	499 to 535	29
126 to 143	15	536 to 573	30

SAFETY FACTOR TABLE FOR NORMAL DEMAND ITEMS

The service function table for the normal distribution of forecast errors which includes a conversion factor for mean absolute deviation to standard deviation is:

Variable Safety Factor	Service Function
0.0	.4998
0.2	.4062
0.4	.3252
0.6	.2561
0.8	.1985
1.0	.1510
1.2	.1131
1.4	.0289
1.6	.0600
1.8	.0425
2.0	.0294
2.2	.0199
2.4	.0134
2.6	.0088
2.8	.0056
3.0	.0035
3.2	.0023
3.4	.0015
3.6	.0009
3.8	.0005
4.0	.0004

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